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ABSTRACT

This directory provides descriptions of marine academic programs in California's community colleges, 4-year private colleges and universities, and 4-year public colleges and universities. Each program listing (by institution) includes; (1) program title corresponding to official degree title; (2) degree(s) offered; (3) descriptive information gathered from 1978-79 general college catalogs, program brochures, and telephone interviews; (4) number of graduate and undergraduate marine science or marine science-related courses offered by the degree-sponsoring institution; (5) number of faculty; (6) description of research facilities; and (7) name, address, and telephone number of contact person. Two tables and one chart are included. Tables list those 2- and 4-year institutions with marine research affiliations (marine stations, centers, institutes, or laboratories complementing an institution's marine science program). The chart identifies each 4-year public and private institution that offers a degree program in marine science, listing private institutions first with public institutions following. (Author/JN)

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Directory of
Academic Marine Programs in California

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by
Kelly Elizabeth Anderson

Science Writing Program
University of California, Santa Cruz

A California Sea Grant College Program Publication

Report # R-CSGCP-003

SEA GRANT CALIFORNIA

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The California Sea Grant College Program is a statewide multi-university program of marine research, education, and advisory services, administered by the University of California Institute of Marine Resources. Sea Grant-sponsored research contributes to the growing body of knowledge about our coastal and oceanic resources and to the solution of contemporary problems in the marine sphere. Through its Marine Advisory Program, Sea Grant transfers information and technology developed in research efforts to a wide community of users in California, the region and the nation. Sea Grant also supports a broad range of educational programs for university students, public school teachers and students, and the general public so our coastal and oceanic resources may be understood and judiciously used by this and future generations.

Cover design by Steve Cook

DIRECTORY OF ACADEMIC MARINE PROGRAMS IN CALIFORNIA

Community Colleges, Four-Year Colleges, and Universities

by

Kelly Elizabeth Anderson
Science Writing Program
University of California, Santa Cruz

1980

Report # R-CSGCP-003

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INTRODUCTION

This directory was published by the California Sea Grant College Program to provide guidance counselors and students with comprehensive information about marine academic offerings of California's institutions of post-secondary education. It was compiled by Ms. Kelly Anderson as a science-writing internship project at the University of California, Santa Cruz. We are pleased to publish and distribute what we hope will be a valuable reference aid for people whose academic and professional goals involve ocean-related endeavors.

The wide array of courses and degree programs described here offers the potential college student options for planning an academic program with a marine focus. It should also dispel the common misconception that options for those who wish to pursue a marine-related career are limited to traditional fields in the biological or physical sciences and engineering. We intend to publish a revision two years from now to ensure accuracy and completeness of the listings. Comments and suggestions for improvement of the directory are more than welcome.

The California Sea Grant College Program, which began in 1968 on the San Diego campus of the University of California, is a statewide program that supports research, education, and public advisory services in the marine area. Funding is provided through the National Sea Grant College Program, a part of the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce, and through the State Resources Agency.

Creation of the National Sea Grant College Program by an act of Congress in 1966 (Public Law 89-688) was one important outcome of widespread concern over the nation's oceanic resources. Congress established Sea Grant as a means of tapping the intellectual resources of the nation's universities to further our knowledge of marine resources; to train future marine scientists and engineers; and to support new or developing marine industries. Sea Grant now supports local programs in twenty-eight coastal and Great Lakes states. It was conceived as a partnership of university, government, and industry to foster the intelligent use, development and management of the nation's ocean and coastal resources.

For additional information on Sea Grant, please write: California Sea Grant College Program, A-032, University of California, La Jolla, California 92093.

James J. Sullivan
Program Manager

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EXPLANATION OF PROGRAM DESCRIPTION CATEGORIES

PROGRAM: Program titles are listed according to official degree titles, with a few exceptions. These exceptions are noted parenthetically and explained in the program's "Description" section. For example, "biology (with marine emphasis)" means the institution officially offers a biology degree, and students working toward that degree can create a marine biology emphasis by choosing several marine science courses. So, although the institution does not offer an official "biology with emphasis in marine biology" degree, the standard biology program allows students to concentrate in marine biology.

DEGREE OFFERED: To avoid ambiguity, degrees are listed according to the abbreviations used by each institution. In most cases, these are standard abbreviations. The exceptions are spelled out: "Certificate," rather than C, and "Doctor of Engineering," to distinguish from a "Doctor of Philosophy in Engineering" (Ph.D. is used here).

Standard abbreviations include A.A. (Associate of Arts), A.S. (Associate of Science), B.A. (Bachelor of Arts), B.S. (Bachelor of Science), M.A. (Master of Arts), M.S. (Master of Science), and Ph.D. (Doctor of Philosophy).

DESCRIPTION: Program description information was gathered from several sources: general college catalogs, program brochures and phone interviews. Campus contacts edited the final descriptions to ensure accuracy. To ensure the directory's accuracy, only 1978-1979

catalogs were used. Supplementary information, such as research facilities, contact persons, and program brochures, was obtained by mail request and through phone interviews with the contact person or an administrative assistant. In cases where no college catalogs were available (less than eight percent overall), program information was obtained over the phone, from brochures, and from the contacts themselves.

NUMBER OF MARINE SCIENCE COURSES: Unless otherwise stated, "number of marine science courses" includes only those courses clearly marine science (or marine science related) and offered by the degree-sponsoring department. Such courses include those in marine biology, physical oceanography, and marine invertebrate zoology. Since interdepartmental programs require courses from several disciplines, their courses are not tabulated.

Two-year institutions' courses are listed according to the number of marine science courses per total number of department courses. Four-year schools' courses are generally designated as undergraduate or graduate.

NUMBER OF FACULTY: In most cases, this figure is the number of faculty members in the degree-sponsoring department. It is difficult to determine the number of specifically marine science faculty in a department, as most catalogs do not distinguish faculty research interests. In several cases the contact person identified the specific number and these are listed as specifically marine.

RESEARCH FACILITIES: To maintain accuracy, the research facility descriptions often contain entire passages from catalogs or brochures, or from the contact person's editorial changes. Minor editing and condensing was done in

most cases. Major editing was required only for a few large marine facilities, such as Scripps Institution of Oceanography and Moss Landing Marine Laboratories.

CONTACT: In all cases, the contact person was identified by phone, either by talking to the department's administrative assistant or by speaking directly to the contact person. Each contact was then notified at least once and, in several cases, twice, by mail. During the editing process extra contacts were recommended, and each is listed. In a few cases these additional contacts were not notified, since the program descriptions had already been approved by qualified contacts for the programs. Nearly all contacts either teach or do research in a marine science field.

TWO-YEAR COLLEGES

TWO-YEAR COLLEGE OF MARIN

PROGRAM: MARINE SCIENCE TECHNOLOGY

DEGREE OFFERED: Certificate / A.A. / A.S.

DESCRIPTION: College of Marin offers a broad marine science technology program for three kinds of students:

1. Those interested in marine education experience for self enrichment
2. Those majoring in a science discipline, e.g., biology, geology, etc., with the eventual goal of obtaining a B.A. degree
3. Those interested in a two-year career curriculum with the goal of being certified and working as a marine science aide or technician.

The college offers several general marine interest courses, including courses in oceanography, general biology, marine biology, marine organisms, diving, field ecology, general ecology, nature study, and marine field studies.

The student interested in eventually majoring in marine biology at a four-year institution is advised to take courses in general biology, botany, mathematics (through calculus), general chemistry and physics, reading and composition, and three marine science courses--namely, marine biology, marine organisms, and marine field studies.

Students interested in a two-year career curriculum in the marine sciences pick an area of specialty, usually biology, electronics, data processing, or geology. The program is by design--students must construct their own program with faculty supervision. At the end of two years, the student may receive an A.A. degree plus a certificate of training, depending on the individual program.

In addition to the courses available at the campus, courses are taught at the College of Marin's Bolinas Marine Station. Scuba diving certificaton is available through the physical education department at the campus.

NUMBER OF MARINE SCIENCE COURSES: 5 (not applicable--interdepartmental program)

NUMBER OF FACULTY: Not applicable--interdepartmental program

RESEARCH FACILITIES: Much of the classroom and laboratory study is conducted at the College of Marin's Bolinas Marine Station. The station is situated in the oceanside community of Bolinas, 22 miles north of San Francisco. The marine station includes a marine laboratory equipped with 20 student stations. The station has a circulating seawater system which supplies laboratory aquaria for instructional research purposes.

RESEARCH FACILITIES:

(cont.) The station also has Boston whalers and a 40-foot diesel-powered boat for shallow and deepwater studies. Marine investigations are conducted year-round by class groups and by individuals working on research projects.

CONTACT: Al Molina, Director
Bolinas Marine Station
Bolinas, California
94924 (415) 868-1771
or (415) 485-9542

or

Gordon L. Chan
Instructor of Biology
College of Marin
Kentfield, California
94904 (415) 485-9537

or

Jim Locke
Instructor of Geology
College of Marin
Kentfield, California
94904 (415) 485-9526

TWO-YEAR

FULLERTON COLLEGE

PROGRAM: OCEANOGRAPHIC TECHNOLOGY

DEGREE OFFERED: A.A.

DESCRIPTION: Fullerton offers an Associate of Arts degree program in oceanographic technology. The two-year curriculum leads to future studies in oceanography, or immediate employment with industries, institutions, and government agencies. During the first year, students are required to take courses in oceanography, math, chemistry, English, scientific instrumentation, and biology. During the second year, students take courses in ocean sampling, marine biology, physics, social science, the humanities, navigation and seamanship, physical geology, and aquaculture.

Recommended electives to round out the student's program include courses in data processing, FORTRAN programming, microbiology, photography, electronic theory and devices, electronic construction techniques, surveying, oceanographic technician training, welding, scientific communication, diving, and underwater photography.

NUMBER OF MARINE SCIENCE COURSES: 7 (out of 12)

NUMBER OF FACULTY: 3

RESEARCH FACILITIES: The college has two small vessels, and oceanographic sampling equipment. A cooperative program allows students to participate in shipboard research activities aboard vessels belonging to the University of Southern California.

CONTACT:

Larry Leyman
Instructor of Oceanography
Division of Life Sciences
Fullerton College
321 East Chapman Avenue
Fullerton, California
92634 (714) 871-8000 (ext. 263)
or (714) 495-0816

PROGRAM: ENVIRONMENTAL SCIENCES

DEGREE OFFERED: A.A.

DESCRIPTION: Los Angeles Pierce offers a two-year training program leading to an Associate of Arts degree in environmental sciences. The program includes courses in soil analysis, chemistry, physical science, biology, urban planning, and architecture, in addition to a full year of courses in physical oceanography and marine biology.

L.A. Pierce, in cooperation with the Claremont Colleges, uses the Vantuna, an 85-foot oceanographic vessel, for deep water studies. Students enrolled in the oceanography lab course take five trips on the Vantuna, and use the vessel's equipment to conduct lab experiments for the course.

L.A. Pierce offers five courses in oceanography. Enrollment in these courses averages about 500 students in the introductory course, and then about 60 students in the supplementary courses, per semester.

NUMBER OF MARINE SCIENCE COURSES: 5 (out of 5)

NUMBER OF FACULTY: 4

RESEARCH FACILITIES: L.A. Pierce has access to the Vantuna, a large, deep-sea research vessel operated by the Claremont Colleges. Students do field work in the intertidal zone at Leo Carrillo State Beach or Malibu Lagoon.

CONTACT:

Barbara Hopper
Professor of Marine Biology
Los Angeles Pierce College
6201 Winnetka Avenue
Woodland Hills, California
91364 (213) 347-0051

PROGRAM: OCEANOGRAPHY PREPARATORY

DEGREE OFFERED: None

DESCRIPTION: Mt. San Antonio does not have a degree program in any of the marine sciences. However, it does have a preparatory program designed for students interested in majoring in oceanography at other colleges or universities to which they intend to transfer. Although institutions offer baccalaureate programs in oceanography, Mt. San Antonio suggests that students who wish to have a career in oceanography may be better prepared by undertaking a baccalaureate program in a basic science and doing graduate work toward an oceanographic application of the chosen science.

Preparation for the oceanography degree includes two courses in oceanography (one general, one lab), two courses in marine biology (one general, one lab), and courses in statistics, calculus, analytic geometry, engineering, physics, physical geology, historical geology, chemistry, zoology, and botany.

NUMBER OF MARINE SCIENCE COURSES: 4 (out of 18)

NUMBER OF FACULTY: 5

RESEARCH FACILITIES: None

CONTACT:

Larry Redinger, Chairman
Department of Earth Sciences
Mt. San Antonio College
1100 N. Grand Avenue
Walnut, California
91789 (714) 594-5611

or

Harold Thurman
Instructor of Oceanography
Mt. San Antonio College
1100 N. Grand Avenue
Walnut, California
91789 (714) 594-5611

PROGRAM: MARINE SCIENCE PREPARATORY

DEGREE OFFERED: None

DESCRIPTION: Orange Coast offers a curriculum that prepares the student to transfer to a four-year institution, with the goals of a baccalaureate degree in a marine science and future graduate work.

To prepare the transfer student, Orange Coast suggests a two-year program including courses in mathematics, chemistry, biology, and physics. The marine science faculty and the counselors at the college assist the students in selecting a four-year institution and establishing a faculty contact there.

The college recommends that students interested in becoming biological oceanographers get a bachelor's degree in some aspect of biology. Students interested in chemical oceanography should get an undergraduate degree in chemistry. Those interested in geological oceanography should get a degree in geology. A physical oceanographer needs an undergraduate degree in physics, mathematics, or meteorology, or some combination of these. Sometimes a degree in engineering is acceptable. A marine resource management major should have a degree in either natural science, social-political science, or engineering.

NUMBER OF MARINE SCIENCE COURSES: 8 (out of 8)

NUMBER OF FACULTY: 5

RESEARCH FACILITIES: See description on page 18.

CONTACT:

Tom Garrison
Marine Science Department
Orange Coast College
2701 Fairview Road
Costa Mesa, California
92626 - (714) 556-5647

PROGRAM: MARINE TECHNOLOGY

DEGREE OFFERED: A.A.

DESCRIPTION: Orange Coast offers a two-year Associate of Arts degree program in marine technology. The program is strictly vocational; some of the course work is not transferrable to a four-year college. The program trains the student as a marine technician. "Marine technician" describes the occupational range between the baccalaureate professional and the craftsman without a college degree. The student trained as a marine technician may be employed directly as a seagoing or ocean technician aboard ship, or as a technician only partly involved in marine activities.

The field of marine technology includes oceanography; marine oil exploitation and mining; scientific research in marine-related biology, chemistry, pharmacology; fisheries technology; mariculture; aquarium management; seafood processing; and marine consultation.

The courses required of students in marine technology are selected and monitored by the members of the college's Marine Science Advisory Committee. The committee members are leaders in the ocean industries and environmental agencies in southern California, administrators of the college, faculty within the department, and students in the program.

The two-year technical curriculum leading to an A.A.

degree includes courses in technical math, electronics, skindiving, chemistry, ocean resources, marine biology, physics, diving, seamanship and navigation, wastewater examination, technical report writing, oceanographic techniques, geology, ecology, biology, welding, drafting, and machine shop practices.

NUMBER OF MARINE SCIENCE COURSES: 8 (out of 8)

NUMBER OF FACULTY: 5

RESEARCH FACILITIES: The Marine Science Center at Orange Coast College has training equipment that includes spectrophotometers, pH meters, oxygen tension analyzers, salinometers, water-immersion Nikon microscopes, dissection microscopes and optics, a 3,200 gallon "closed system" circulating marine aquarium for display and specimen storage, a "wet" marine laboratory with cold-room capability, a Questar optical system for long-range study, telemicroscopy, and navigation, a Gilson differential respirometer, absorption spectrometer, and gas chromatograph, on-line computing capability with the college's IBM System/370, two 16-foot Boston whalers and two 23-foot SeaCraft inboard-outboard vessels for field work, and instruments for measuring salinity, pH, conductivity, trace elements and other physical parameters in the field. The department also purchases time on large, ocean-going research vessels.

CONTACT:

Tom Garrison
Marine Science Department
Orange Coast College
2701 Fairview Road
Costa Mesa, California
92626 (714) 556-5647

PROGRAM: COMBINATION OF TECHNICAL AND TRANSFER

DEGREE OFFERED: A.A.

DESCRIPTION: Orange Coast offers a curriculum for students who are unable to decide whether to pursue the two-year (technical) or four-year (theoretical) educational goal. The program is designed for students interested in direct employment into a marine science career, or an associate degree and future baccalaureate degree.

Courses in the curriculum include a general course in the marine sciences, and courses in ocean resources, seamanship and navigation, marine biology, oceanographic technology, calculus, electronics, chemistry, programming, physics, water analysis, skindiving, diving, and technical report writing, in addition to courses satisfying the general education requirements. This program, because it combines nearly two two-year programs, requires more than four semesters to complete.

NUMBER OF MARINE SCIENCE COURSES: 8 (out of 8)

NUMBER OF FACULTY: 5

RESEARCH FACILITIES: See description on page 18.

CONTACT:

Tom Garrison
Marine Science Department
Orange Coast College
2701 Fairview Road
Costa Mesa, California
92626 (714) 556-5647

TWO-YEAR

SADDLEBACK COLLEGE

PROGRAM: MARINE SCIENCE TECHNOLOGY

DEGREE OFFERED: Certificate / A.S.

DESCRIPTION: Saddleback College offers both general Certificate and Associate of Science degree programs in marine science technology. Students in the program are trained in several areas: vessel and equipment maintenance and operation; diving techniques; environmental impact study procedures; mariculture operations; and marine geological, chemical, physical, and biological research.

Students take a variety of marine science courses, including Geological and Physical Oceanography; Sailing, Seamanship, and Safety Afloat; Coastal Navigation; Oceanographic Instrumentation; Technical Mathematics; Biological and Chemical Oceanography; Diving and Underwater Techniques; Marine Science Research Techniques; Underwater Scientific Photography; and Technical Writing.

NUMBER OF MARINE SCIENCE COURSES: 20 (out of 20)

NUMBER OF FACULTY: (not available)

RESEARCH FACILITIES: Training includes classroom and laboratory work at the campus, which is complete with modern training equipment. When at sea, work is done aboard the college's oceanographic research vessels, both sail and power. Field study experience is done throughout southern California where innumerable government and private operations are viewed firsthand.

CONTACT:

John Minch, Coordinator
Marine Science Programs
Saddleback College
2800 Marguerite Parkway
Mission Viejo, California
92692 (714) 831-4736
or (714) 831-4820

PROGRAM: MARINE SCIENCE TECHNOLOGY with MARINE BIOLOGY EMPHASIS

DEGREE OFFERED: Certificate / A.S.

DESCRIPTION: Saddleback College offers both Certificate and Associate of Science degree programs in marine science technology with emphasis in marine biology. The marine science technology program trains students in vessel and equipment maintenance and operation; diving techniques; environmental impact study procedures; mariculture operations; and marine geological, chemical, physical, and biological research.

Students wanting a marine biology emphasis take courses such as Geological and Physical Oceanography; Sailing; Seamanship, and Safety Afloat; General Chemistry; Biology of Non-Vascular Plants; Oceanographic Instrumentation; Invertebrate Zoology; Biological and Chemical Oceanography; Diving and Underwater Techniques; Coastal Navigation; and Organic Chemistry.

NUMBER OF MARINE SCIENCE COURSES: 20 (out of 20)

NUMBER OF FACULTY: (not available)

RESEARCH FACILITIES: See description on page 22.

CONTACT:

John Minch, Coordinator
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Mission Viejo, California
92692 (714) 831-4736
or (714) 831-4820

PROGRAM: MARINE SCIENCE TECHNOLOGY with MARINE GEOLOGY EMPHASIS

DEGREE OFFERED: Certificate / A.S.

DESCRIPTION: Saddleback College offers both Certificate and Associate of Science degree programs in marine science technology with emphasis in marine geology. Students are trained in several areas, including vessel and equipment maintenance and operation; diving techniques; environmental impact study procedures; mariculture operations; and marine geological, chemical, physical, and biological research. Students emphasizing marine geology take courses such as Geological and Physical Oceanography; Sailing, Seamanship, and Safety Afloat; Coastal Navigation; General Chemistry; Oceanographic Instrumentation; Technical Mathematics; Introduction to Physical Geology; Biological and Chemical Oceanography; Diving and Underwater Techniques; Marine Science Research Techniques; Underwater Scientific Photography; Historical Geology, and Technical Writing.

NUMBER OF MARINE SCIENCE COURSES: 20 (out of 20)

NUMBER OF FACULTY: (not available)

RESEARCH FACILITIES: See description on page 22.

CONTACT:

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Saddleback College
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PROGRAM: MARINE SCIENCE TECHNOLOGY with PHYSICAL OCEANOGRAPHY EMPHASIS

DEGREE OFFERED: Certificate / A.S.

DESCRIPTION: Saddleback College offers both Certificate and Associate of Science degree programs in marine science technology with emphasis in physical oceanography. Students are trained in several areas, such as vessel and equipment maintenance and operation; diving techniques; environmental impact study procedures; mariculture operations; and marine geological, chemical, physical, and biological research. Students emphasizing physical oceanography take courses such as Geological and Physical Oceanography; Sailing, Seamanship and Safety Afloat; Coastal Navigation; General Chemistry; Oceanographic Instrumentation; Technical Mathematics; Introduction to Physical Geology; Biological and Chemical Oceanography; Diving and Underwater Techniques; Marine Science Research Techniques; Underwater Scientific Photography; Historical Geology; and Technical Writing.

NUMBER OF MARINE SCIENCE COURSES: 20 (out of 20)

NUMBER OF FACULTY: (not available)

RESEARCH FACILITIES: See description on page 22.

CONTACT:

John Minch, Coordinator
Marine Science Programs
Saddleback College
2800 Marguerite Parkway
Mission Viejo, California
92692 (714) 831-4736
or (714) 831-4820

PROGRAM: MARINE SCIENCE TECHNOLOGY with SEAMANSHIP EMPHASIS

DEGREE OFFERED: Certificate / A.S.

DESCRIPTION: Saddleback College offers both Certificate and Associate of Science degree programs in marine science technology with emphasis in seamanship. Students are trained in several areas, such as vessel and equipment maintenance and operation; diving techniques; environmental impact study procedures; mariculture operations; and marine geological, biological, and physical research. Students emphasizing seamanship take courses such as Geological and Physical Oceanography; Sailing, Seamanship, and Safety Afloat; Diesel Engine Preventive Maintenance and Tune-up; Oceanographic Instrumentation; Technical Mathematics; A.C. and D.C. Fundamentals; Biological and Chemical Oceanography; Coastal Navigation; Diving and Underwater Techniques; Marine Science Research Techniques; Underwater Scientific Photography; Celestial Navigation; Industrial Electronics; and Technical Writing.

NUMBER OF MARINE SCIENCE COURSES: 20 (out of 20)

NUMBER OF FACULTY: (not available)

RESEARCH FACILITIES: See description on page 22.

CONTACT:

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2800 Marguerite Parkway
Mission Viejo, California
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or (714) 831-4820

TWO-YEAR

SAN DIEGO EVENING COLLEGE

PROGRAM: BOAT- AND SHIPBUILDING AND REPAIR

DEGREE OFFERED: Certificate

DESCRIPTION: San Diego Evening College offers four-year programs in boat- and shipbuilding and marine repair trades. The program is offered in cooperation with local union, shipbuilding, and boat-buiding organizations, including the Machinist Joint Apprenticeship Committee of the International Associaton of Machinists. Apprentices enroll in special courses selected by joint apprenticeship committees.

NUMBER OF MARINE SCIENCE COURSES: 1 (out of 1)

NUMBER OF FACULTY: (Interdepartmental program)

RESEARCH FACILITIES: None

CONTACT:

Florence H. Downs
Manpower, Training, and Vocational Education Services
San Diego Community College District
3375 Camino del Rio South
San Diego, California
92108 (714) 280-7610

TWO-YEAR

SAN DIEGO EVENING COLLEGE
SAN DIEGO MESA COLLEGE

PROGRAM: MARINE OCCUPATIONS

DEGREE OFFERED: Certificate / A.S.

DESCRIPTION: San Diego Evening College and San Diego Mesa College offer both Certificate and Associate Degree programs in marine occupations. The programs provide general knowledge of the marine environment, the coastal zone, and resources. They develop basic skills related to marine operations, communications, and equipment.

Students can select occupational electives suitable for the marine-oriented occupations of their choice. Such occupations, include marine draftsman, ship's cook, fishery aid, harbor construction technician, marine hardware salesman, lifequard, or the like.

The curriculum includes general education requirements and courses in aspects of the marine environment and operation, such as courses in marine biology and biological oceanography. Technical courses can be taken in marine electricity, shipbuilding, insurance, aquatic recreation, and shop apprenticeship.

NUMBER OF MARINE SCIENCE COURSES: 8 (out of 9)

NUMBER OF FACULTY: 3

RESEARCH FACILITIES: None

CONTACT:

Will Tappen, Instructional Supervisor
Marine Science Program
San Diego Evening College
3375 Camino del Rio South
San Diego, California
92108 (714) 238-1181

or

Robert Arnold, Dean of Occupational Education
San Diego Mesa College
7250 Mesa College Drive
San Diego, California
92108 (714) 279-2300

TWO-YEAR

SANTA BARBARA CITY COLLEGE

PROGRAM: MARINE DIVING TECHNOLOGY

DEGREE OFFERED: A.S.

DESCRIPTION: Santa Barbara City College offers an Associate of Science degree program in marine diving technology. The program prepares the student to become a marine diving technician, in response to the growing needs of offshore industry engaged in underwater construction and the worldwide development of marine resources.

Students in the program must take three different types of courses. The first is designed to develop the skills and knowledge required of a diving technician. Such courses include Seamanship and Small Boat Handling; Basic Diving (Scuba and Hookah); Drawing and Blueprint Reading; Marine Welding; Advanced Diving; Fundamentals of Marine Engines and Compressors; Combination Welding; Underwater Construction; Fundamentals of Electronics; Machine Shop Operations; Underwater Operations; and Diving Systems.

The second series of courses is designed to give students an understanding of the environment in which they will be working. Sample courses include Physical Oceanography for Marine Diving Technology, Marine Biology, Biological Oceanography, and Technical Physics. The third series consists of general education courses--such as Technical Report Writing, Speech and American Institutions--that increase the student's knowledge and communicative ability.

The Marine Diving Technology Program is a cooperative

effort among Santa Barbara City College and various industries, institutions, and government agencies. The program was developed and is continually reviewed and revised by members of an advisory committee, in order to effectively serve the current needs of the offshore industry. Advisors to the program include representatives from Brooks Institute of Photography, Delco Electronics, Naval Civil Engineering Laboratory, Ocean Systems, Inc., Oceaneering International, Santa Barbara Medical Clinic, Scripps Institution of Oceanography, Standard Oil of California, Sub-Sea International, Inc., Taylor Diving and Salvage Company, Inc., and the University of California, Santa Barbara.

NUMBER OF MARINE SCIENCE COURSES: 12 (out of 12)

NUMBER OF FACULTY: 4

RESEARCH FACILITIES: The program moved into its new facility on the main campus in the fall of 1978. The facility houses the diving equipment and training tanks, and includes a 7 1/2 ton bridge crane for handling heavy equipment, such as diving bell, decompression chambers, and compressors.

Santa Barbara City College receives much of its equipment through donations by industry. It has a bell/saturation diving system, which includes an Ocean Systems ADS IV bell and deck chamber, a control van, and the required life support and environmental control components, all acquired through donations.

CONTACT:

Ramsey Parks, Chairman
Marine Technology Department
Santa Barbara City College
721 Cliff Drive
Santa Barbara, California
93109 (805) 965-0581 ext. 426/427

PROGRAM: MARINE BIOLOGY PREPARATORY

DEGREE OFFERED: None

DESCRIPTION: Skyline offers an informal preparatory program for students interested in obtaining a baccalaureate degree in marine biology at a four-year institution. In addition to the courses offered at the campus, Skyline students can enroll in the Bay Discovery Workshop and other courses offered by the Marine Ecological Institute, (M.E.I.). A description of the workshop and the Institute's facilities are located under the description of College of Notre Dame's biology program.

NUMBER OF MARINE SCIENCE COURSES: 3 (out of 22)

NUMBER OF FACULTY: Not applicable--interdepartmental program

RESEARCH FACILITIES: See description of M.E.I. under College of Notre Dame, on page 51.

CONTACT:

Don Biederman
Director of Science and Math Programs
Skyline College
San Bruno, California
94066 (415) 355-7000

or

Carl Wells, Director/Special Projects
Marine Ecological Institute
811 Harbor Boulevard
Redwood City, California
94063 (415) 364-2760

FOUR-YEAR PRIVATE COLLEGES AND UNIVERSITIES

FOUR-YEAR PRIVATE

CALIFORNIA INSTITUTE OF TECHNOLOGY

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.S. / M.S. / Ph.D.

DESCRIPTION: There is no official "biology with marine emphasis" degree program at Caltech. However, students can make arrangements to take courses in marine biology offered at the Santa Catalina Marine Biological Laboratory. Using the courses offered there, students can complete the requirements for the biology major and graduate with a Bachelor of Science degree that reflects a strong marine biology emphasis.

An exchange program has been established with the Scripps Institution of Oceanography (SIO), University of California, San Diego, permitting Caltech graduate students to enroll in and receive credit for graduate courses offered by SIO. Thesis research in the marine sciences is also done at SIO.

NUMBER OF MARINE SCIENCE COURSES: Not applicable

NUMBER OF FACULTY: 56

RESEARCH FACILITIES: In addition the facilities offered by Santa Catalina Marine Biological Laboratory and SIO, Caltech has its own facilities, namely the William G. Kerckhff Marine Laboratory at Corona del Mar. The facility houses several laboratories for research in marine physiology and developmental biology. It is equipped with its own shop, has boats and tackle for collecting marine

animals, and running seawater aquara for keeping them.

CONTACT:

Charles J. Brokaw
Professor and Executive Officer, Biology
William G. Kerckhoff Marine Laboratory
101 Dahlia Street
Corona del Mar, California
92625 (714) 673-9894

PROGRAM: CIVIL ENGINEERING (with COASTAL EMPHASIS)

DEGREES OFFERED: B.S. / M.S. / Ph.D.

DESCRIPTION: Civil engineering includes the research, development, planning, design, and construction associated with urban development, water supply, energy generation and transmission, water treatment and disposal, and transportation. It deals with the function and safety of such public facilities as buildings, bridges, pipelines, dams, rivers, power plants, and harbors; and is concerned with the protection of the public against natural hazards of earthquakes, winds, floods, landslides, water waves, and fires.

Advances of recent years in technology and the escalation of urban problems have broadened the applications of civil engineering and increased the scope of research in that field. New problems have presented special challenges to the civil engineer well trained in the fundamentals of his or her profession. For this reason, in the advanced study of civil engineering at the Institute, emphasis is placed on the application of basic scientific principles and mathematics to the solution of engineering problems.

Graduate work leading to advanced degrees is chiefly in the following fields: structural engineering and applied mechanics; earthquake engineering; soil mechanics and foundation engineering; hydraulics, which includes hydrodynamics, hydraulic engineering, hydrology and coastal engineering; and environmental

engineering (see also Environmental Engineering Science). In recent years, graduate students and members of the staff have pursued a variety of research programs, including analysis of structures subjected to earthquakes and other dynamic loadings; the use of finite element methods for structural analysis; soil deformation under stress; lunar soil studies; permafrost; investigation of laws of sediment transportation and dispersion in bodies of water; turbulent mixing in density stratified flows; wave-induced harbor oscillations; tsunamis; design criteria for various hydraulic structures; aerosol filtration; radioactive waste disposal; water reclamation; and ocean outfalls for thermal discharges or sewage effluents.

Students whose interests are in environmental problems may enroll for graduate degrees in either civil engineering or environmental engineering science.

NUMBER OF MARINE SCIENCE COURSES: 0

NUMBER OF FACULTY: 3

RESEARCH FACILITIES: Civil engineering activities are housed in two buildings, the Franklin Thomas Laboratory, which contains the soil mechanics laboratory, the earthquake engineering laboratory, and the dynamics laboratory, and the W. M. Keck Engineering Laboratories, which contain the laboratory of hydraulics and water resources and the environmental engineering laboratory.

Excellent digital computing facilities are housed in the Booth Computing Center.

CONTACT:

Paul C. Jennings
California Institute of Technology
1201 E. California Boulevard
Pasadena, California
91125 (213) 795-6811

PROGRAM: GEOPHYSICS

DEGREES OFFERED: B.S. / M.S. / Ph.D.

DESCRIPTION: In the Division of Geological and Planetary Sciences, study of the earth and planets is pursued with the aim of understanding their origin, constitution, and development, and the impact of the resulting physical and chemical environments on the history of life, and on man. The approach to these problems is made with strong reliance on the basic sciences; close contact and interaction with the other divisions of the Institute are cultivated. Programs of study and research are pursued in geology, geobiology, geochemistry, geophysics, and planetary science.

The geographical position and geologic setting of the Institute are favorable for year-round field access to a wide variety of earth problems and materials. Current advances in understanding the dynamic motions of the earth's crust and the structure of the interior have opened up new opportunities for research into the processes responsible for the earth's development and activity. Seismic activity in the southern California area presents stimulus and research material for the study of earthquakes, which are of great practical concern and are intimately related to the earth's development on a global scale. Human records of seismic activity are put into long-term perspective by studies of surface and bedrock geology, which reveal the history of motion on fault systems. Major events in the chemical and physical evolution of the earth

can be identified by studying the structure and chemistry of rocks formed or modified in these events, and their absolute chronology can be established by measurements of radioactive isotopes. Stable isotopes can indicate the temperature conditions both of deep-seated events and of the habitat of ancient life, whose chemical and structural evolution responded to the changing environment provided by the developing earth. The earliest history of the earth can be approached via the history of the moon, which is being revealed by studies of lunar samples obtained in the Apollo missions. Further breadth in our understanding of the earth and its place in the cosmos is being gained by comparative study of other planets--their atmospheres, surfaces, and internal structures.

NUMBER OF MARINE SCIENCE COURSES: 6

NUMBER OF FACULTY: 11

RESEARCH FACILITIES: The Seeley G. Mudd Building of Geophysics and Planetary Science has just been completed on the campus adjacent to the Arms and Mudd Laboratories. It provides research and teaching facilities for seismology, experimental geophysics, and planetary science. The Seismological Laboratory of the Institute, with excellent facilities including computers and extensive shops, is also located in the Seeley G. Mudd Building. The Kresge Laboratory is located about three miles west of the campus on crystalline bedrock affording firm foundation for the instrument piers and tunnels. These laboratories, together with a dozen portable and seventeen permanent outlying auxiliary stations in southern California, which were built and are maintained with the aid of cooperative companies and organizations, constitute an outstanding center for

education and research in seismology. In addition, special facilities are available at the Seismological Laboratory for the study of the behavior of rocks and minerals in the pressure and temperature environments of planetary interiors. These facilities include laboratories for performing ultrasonic and Brillouin scattering measurements of elastic constants of rocks and minerals at high pressures and temperatures. Ultra-high-pressure equations of state and shock effects in minerals are being studied in a shock-wave laboratory.

CONTACT:

Barclay Kamb
Geological and Planetary Sciences
California Institute of Technology
1201 E. California Boulevard

Pasadena, California
91125 (213) 795-6811

FOUR-YEAR PRIVATE

CLAREMONT MEN'S COLLEGE

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.A.

DESCRIPTION: Claremont Men's College does not offer an official "biology with marine emphasis" degree program. However, students can design such a major with faculty supervision. Claremont Men's offers all of the basic undergraduate programs in science through a joint science department, which services the science needs of Scripps and Pitzer Colleges as well. Currently there are several students doing their senior theses in marine science fields at Claremont Men's College.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate 0 graduate

NUMBER OF FACULTY: 13

RESEARCH FACILITIES: Claremont Men's college has three constant temperature rooms, seawater systems, two boats (one outboard skiff and an inboard/outboard cruiser), scuba gear, and underwater photography equipment.

CONTACT:

Robert Feldmeth
Joint Science Department
Claremont Men's College
Claremont, California
91711 (714) 621-8000 (ext. 2679)

FOUR-YEAR PRIVATE

COLLEGE OF NOTRE DAME

PROGRAM: BIOLOGY with MARINE EMPHASIS

DEGREE OFFERED: A.A. / B.A. / B.S. / M.A.T.

DESCRIPTION: College of Notre Dame offers an associate degree program in biology with marine biology emphasis through the Division of Continuing Education. The higher degree programs, including the Master of Arts in Teaching (biology with marine biology emphasis) are offered through the Marine Resources Center and in cooperation with the Marine Ecological Institute, a non-profit corporation. Students can receive credit for taking the Bay Discovery Workshop and other courses offered by M.E.I.

The five-day Bay Discovery Workshop is offered four times during the summer. The instructors are marine scientists with particular experience in the estuarine environment of San Francisco Bay, and their work is supplemented by guest specialists from colleges, universities, environmental centers, and government agencies.

During the workshop, students study the plant and animal life in the San Francisco Bay, issues in preserving the bay, and the bay's history, energy resources, and estuarine ecology. The workshop offers field experience through tidepool and marshland explorations and aboard the Institute's primary research vessel, the 85-foot Inland Seas--a floating laboratory.

In addition, students are required to do independent research projects, under faculty direction, at the college's Marine Resources Center.

NUMBER OF MARINE SCIENCE COURSES: Not applicable

NUMBER OF FACULTY: Not applicable

RESEARCH FACILITIES: College of Notre Dame students can take the courses offered by the Marine Ecological Institute. The Institute is an educational, informational, and research-oriented facility interested in the marine and estuarine environment of the San Francisco Bay. The Institute has its own staff of qualified instructors.

The Institute operates the 85-foot diesel-powered research vessel, Inland Seas. The vessel weighs 111 gross tons and cruises at 12 knots. It is equipped with radar, radio, and recording fathometer. The vessel is outfitted to collect cores, bottom sediments, water samples, plankton, invertebrates, and fish. Below-deck compartments are equipped as classrooms/laboratories.

The College of Notre Dame's Marine Resources Center is noted for its research on viruses in molluscan shellfish. Students may elect to do research in mariculture, marine microbial pollution, marine ecology, etc. The Marine Resources Center is housed in a physical plant of some 2,500 square feet and contains wet laboratories, as well as facilities for microbiology, virology, physiology, histology, water chemistry, and genetics.

CONTACT:

Dr. DiGirolamo, Director
Marine Resources Center
College of Notre Dame
Ralston Avenue
Belmont, California
94002 (415) 593-1601

or

Carl Wells, Director of Special Projects
Marine Ecological Institute
811 Harbor Boulevard
Redwood City, California
94063 (415) 364-2760

FOUR-YEAR PRIVATE

DOMINICAN COLLEGE OF SAN RAFAEL

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.A.

DESCRIPTION: Dominican College offers no official "biology with marine emphasis" degree program. However, it offers a preparatory program for biology students interested in graduate programs and careers in marine biology.

NUMBER OF MARINE SCIENCE COURSES: 1 undergraduate 0 graduate

NUMBER OF FACULTY: 3

RESEARCH FACILITIES: None

CONTACT:

Sherry Volk, Associate Professor
Department of Biology
Dominican College of San Rafael
San Rafael, California
94901 (415) 457-4440 (ext. 278)

FOUR-YEAR PRIVATE

IMMACULATE HEART COLLEGE

PROGRAM: BIOLOGY with MARINE BIOLOGY CONCENTRATION

DEGREE OFFERED: B.A.

DESCRIPTION: Immaculate Heart offers a program in biology with concentration in marine biology. Students in this program must take several courses in chemistry (organic), physics, and mathemics; and a minimum of 24 units of upper-division biology work. The program is designed for students preparing for graduate work leading to a degree in marine biology.

NUMBER OF MARINE SCIENCE COURSES: 4 undergraduate 0 graduate

NUMBER OF FACULTY: 3

RESEARCH FACILITIES: None

CONTACT:

Damian Juge
Immaculate Heart College
2021 N. Western Avenue
Los Angeles, California
90027 (213) 462-1301 (ext. 289)

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FOUR-YEAR PRIVATE

LOMA LINDA UNIVERSITY

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: M.A. / Ph.D.

DESCRIPTION: Loma Linda does not offer an official "biology with marine emphasis" degree program. However, a graduate student in biology can design an M.A./Ph.D. program that reflects a strong marine biology background. Students can take courses or do research in Anacortes, Washington, at Walla Walla College's marine station.

All Ph.D. candidates, whether emphasizing marine studies or not, are required to have taken a field course or done research in either a tropical or marine environment during either their undergraduate or graduate years.

NUMBER OF MARINE SCIENCE COURSES: 1 undergraduate 1 graduate

NUMBER OF FACULTY: 27

RESEARCH FACILITIES: In coordination with Walla Walla College's marine station in Anacortes, Washington, students can do research or take classes for credit at the marine station.

CONTACT:

Conrad Clausen
Professor of Biology
Department of Biology
Loma Linda University
Loma Linda, California
92350 (714) 796-7311 (ext. 2976)

FOUR-YEAR PRIVATE

LOYOLA MARYMOUNT UNIVERSITY

PROGRAM: BIOLOGY with MARINE OPTION

DEGREE OFFERED: B.S. / Minor in Marine Biology

DESCRIPTION: Loyola Marymount offers a degree program in biology with a marine biology option. In addition to the biology major requirements, the student majoring in marine biology should take as many marine science courses as possible. The biology department recommends seven biology courses from which to choose, as well as one course from chemistry and one from earth science (both upper-division courses). The department also recommends language and psychology courses for the student interested in marine biology.

Loyola Marymount also offers a special minor in marine biology for students majoring in other disciplines. The biology department requires a total of 18 semester hours with it least 9 semester hours in upper-division courses. The courses must be selected under the direction of the chairman of the biology department.

NUMBER OF MARINE SCIENCE COURSES: 8 undergraduate 0 graduate

NUMBER OF FACULTY: 11

RESEARCH FACILITIES: Loyola Marymount operates the Loyola Marymount University Baja California Biological Station, which is located at Coloradito, Baja California Norte, Mexico.

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CONTACT:

Roy Houston, Director
LMU Baja California Biological Station
Department of Biology
Loyola Marymount University
Loyola Boulevard at West 80th Street
Los Angeles, California
90045 (213) 642-3126

or

John Waggoner III, Assistant Director
LUM Baja California Biological Station
Department of Biology
Loyola Marymount University
Loyola Boulevard at West 80th Street
Los Angeles, California
90045 (215) 642-3116

MOUNT ST. MARY'S COLLEGE

PROGRAM: BIOLOGY with MARINE EMPHASIS

DEGREE OFFERED: B.A. / B.S.

DESCRIPTION: The biological sciences major is designed to permit the student to elect an emphasis of study in one of several fields, including marine biology. The program at Mount St. Mary's is designed to prepare students to enter medical school, clinical areas of service, teaching, or graduate school.

NUMBER OF MARINE SCIENCE COURSES: 1 undergraduate 0 graduate

NUMBER OF FACULTY: 5

RESEARCH FACILITIES: There is active neuroendocrine and biochemical research on campus. Marine organisms are often used for this undergraduate research. Study frequently is done on a full-time basis during the summer months.

CONTACT:

Sister Annette Bower
Professor of Biological Sciences
Mount St. Mary's College
12001 Chalon Road
Los Angeles, California
90049 (213) 476-2237 (ext. 271)

FOUR-YEAR PRIVATE

OCCIDENTAL COLLEGE

PROGRAM: MARINE BIOLOGY and BIOLOGY with MARINE EMPHASIS

DEGREE OFFERED: B.A. / M.A.

DESCRIPTION: Occidental offers programs in both biology and marine biology. Students emphasizing marine biology must take nine biology courses, four chemistry courses, two math courses, two physics courses, and two geology courses. Students are encouraged to take lifesaving and scuba, both offered by the physical education department. All students in the program must register for at least one term of Biology Research (Bio 197) as participants in either the deep water research programs aboard the Vantuna or the ecological studies of inshore waters. A term at Santa Catalina Marine Biological Laboratory is recommended.

NUMBER OF MARINE SCIENCE COURSES: 7 undergraduate 0 graduate (courses offered at Santa Catalina)

NUMBER OF FACULTY: 8

RESEARCH FACILITIES: Occidental has several facilities for marine biology studies: Boston whalers for inshore marine studies using scuba equipment; and the Vantuna, an 85-foot oceanographic vessel used for deep water studies. Occidental participates in the Marine Biological Laboratory on Santa Catalina Island, and uses the island laboratory for teaching and research in marine biology.

CONTACT:

John S. Stephens, Jr.
Professor of Marine Biology
Biology Department
Occidental College
1600 Campus Road
Los Angeles, California
90041 (213) 259-2675

FOUR-YEAR PRIVATE

PACIFIC UNION COLLEGE

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.A. / B.S.

DESCRIPTION: Pacific Union offers no official "biology with marine emphasis" degree program. However, the college operates the Mendocino Biological Field Station at Albion, which offers numerous opportunities for study in marine biology. Courses offered at the field station are applicable toward the biology degree. Students interested in future work in marine biology are encouraged to take as many courses at the field station as possible.

NUMBER OF MARINE SCIENCE COURSES: 3 undergraduate 1 graduate (16 summer session courses offered at the field station)

NUMBER OF FACULTY: 7

RESEARCH FACILITIES: Pacific Union operates the Mendocino Biological Field Station at Albion, 100 miles from the college campus. The station is located where the Albion River empties into the Pacific Ocean, and it offers a unique opportunity for studying marine biology.

Facilities include a botany and a marine laboratory, with a saltwater aquarium facility. A 16-foot Boston whaler is available for studies along the coast. Equipment and space are primarily geared to basic studies in marine biology, botany, and ecology.

CONTACT:

Ervil D. Clark, Chairman
Department of Biology
Pacific Union College
Angwin, California
94508 (707) 965-6227

or

Donald Hemphill
Professor of Biology
Department of Biology
Pacific Union College
Angwin, California
94508 (707) 965-6227

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.A.

DESCRIPTION: Pitzer college does not offer an official "biology with marine emphasis" degree program. However, students can design such a major with faculty supervision. Through the joint science department, composed of faculty from three of the Claremont Colleges, namely Pitzer, Scripps and Claremont Men's, Pitzer students can undertake any of the basic undergraduate programs in science. Currently there are several students doing their senior theses in marine science fields.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate 0 graduate

NUMBER OF FACULTY: 13

RESEARCH FACILITIES: The joint science department offers three constant temperature rooms, seawater systems, two boats (one outboard skiff and an inboard/outboard cruiser), scuba gear, and underwater photography equipment.

CONTACT:

Robert Feldmeth
Joint Science Department
Claremont Men's College
Claremont, California
91711 (714) 621-8000 (ext. 2679)

FOUR-YEAR PRIVATE

POMONA COLLEGE

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.A.

DESCRIPTION: Pomona does not offer an official "biology with marine emphasis" degree program. However, students can choose biology electives that will reflect a strong background in marine biology, marine geology, or oceanography. Students at Pomona can also take courses through the joint science department composed of faculty from three of the Claremont Colleges, namely Pitzer, Scripps, and Claremont Men's College. Pomona is well-equipped for class study and independent research in marine biology.

Students interested in the marine sciences can attend a summer session at a coastal or inland biological station. In particular, students at Pomona have spent the summer at Woods Hole, Massachusetts, the Oregon Institute of Marine Biology, and other marine laboratories, attending classes and doing research in marine biology while in residence.

Pomona students take trips on the Vantuna, an 85-foot tuna clipper modified for instruction and reseach in oceanography and marine biology. Trips are taken to coastal and offshore areas to sample benthic and pelagic organisms to a depth of 4,000 meters, and to study physical and chemical characteristics of the marine environment.

NUMBER OF MARINE

SCIENCE COURSES: 8 undergraduate (+2 through joint science dept.)
0 graduate

NUMBER OF FACULTY: 10

RESEARCH FACILITIES: Pomona is a member of an inter-university consortium which operatees the Vantuna, an oceanographic vessel used for deep water studies. The Vantuna is equipped with modern oceanographic instruments and sampling devices.

CONTACT:

Larry Oglesby
Biology Department
Pomona College
6th and College Avenue
Claremont, California
91711 (714) 621-8000 (ext. 2948 or 2950)

FOUR-YEAR PRIVATE

SAINT MARY'S COLLEGE OF CALIFORNIA

PROGRAM: BIOLOGY with MARINE CONCENTRATION

DEGREE OFFERED: B.A.

DESCRIPTION: Saint Mary's offers a biology degree program with several possible areas of concentration, including marine biology. Students can work for credit at cooperating marine biology field stations, including Santa Catalina Marine Biological Laboratory, and Woods Hole, Massachusetts.

NUMBER OF MARINE SCIENCE COURSES: 1 undergraduate 0 graduate

NUMBER OF FACULTY: 7

RESEARCH FACILITIES: In cooperation with marine laboratory facilities such as Santa Catalina Marine Biological Laboratory, and Woods Hole, Massachusetts, students can receive credit for courses taken while in residence there.

CONTACT:

Everett Dodd
Professor of Biology
Biology Department
Saint Mary's College
Moraga, California
94575 (415) 376-4411

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.A.

DESCRIPTION: Scripps College does not offer an official "biology with marine emphasis" degree program. However, students can design such a major with faculty supervision. Through the joint science department, composed of faculty from three of the Claremont Colleges, namely Pitzer, Scripps and Claremont Men's, Scripps students can undertake any of the basic undergraduate programs in science. Currently there are several students doing their senior theses in marine science fields.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate 0 graduate

NUMBER OF FACULTY: 13

RESEARCH FACILITIES: The joint science department offers three constant temperature rooms, seawater systems, two boats (one outboard skiff and an inboard/outboard cruiser), scuba gear, and underwater photography equipment.

CONTACT:

Robert Feldmeth
Joint Science Department
Claremont Men's College
Claremont, California
91711 (714) 621-8000 (ext. 2679)

FOUR-YEAR PRIVATE

STANFORD UNIVERSITY

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.S. / M.S. / Ph.D. (in cooperation with Hopkins Marine Station)

DESCRIPTION: Stanford has no official "biology with marine emphasis" degree program. However, it offers many classes at the Hopkins Marine Station in Pacific Grove. Students who wish to develop a biology program with marine biology emphasis would need to take several classes at the Marine Station.

NUMBER OF MARINE SCIENCE COURSES: 0 undergraduate 0 graduate (20 undergraduate and graduate courses offered at Hopkins)

NUMBER OF FACULTY: 0 (8 at Hopkins)

RESEARCH FACILITIES: Stanford operates the Hopkins Marine Station in Pacific Grove, situated about 90 miles from the main university campus in Palo Alto. The station has several laboratories, a large library, and a sheltered landing place and storage for small boats. The station operates year-round and maintains a permanent staff, increased periodically by visiting faculty.

The station offers course work in the marine sciences year-round. Stanford students at both the undergraduate and graduate levels participate in the extensive marine curricula offered by the station.

CONTACT:

Colin S. Pittendrigh, Director
Hopkins Marine Station
of Stanford University
Pacific Grove, California
93950 (408) 373-0464

PROGRAM: GEOLOGY (with MARINE BIOLOGY MINOR)

DEGREE OFFERED: B.S.

DESCRIPTION: Stanford does not have an official "geology with marine biology minor" degree program. However, they suggest that students can use their elective units to acquire depth in a field outside the earth sciences, such as marine biology.

The Hopkins Marine Station offers classes in the marine sciences. These courses are open to biology majors and to those geology majors studying the marine sciences.

NUMBER OF MARINE SCIENCE COURSES: 3 undergraduate 3 graduate (20 undergraduate and graduate)

NUMBER OF FACULTY: 10 (specifically marine; 2 at Stanford, 8 at Hopkins)

RESEARCH FACILITIES: Stanford has the Hopkins Marine Station in Pacific Grove, situated about 90 miles from the main university campus in Palo Alto. The station has several laboratories, a large library, and a sheltered landing place and storage for small boats. The station operates year-round and maintains a permanent staff, increased periodically by visiting faculty.

CONTACT:

Tjeerd Van Andel
Department of Geology
Stanford University
Stanford, California
94305 (714) 497-0765

or

Colin S. Pittendrigh, Director
Hopkins Marine Station
of Stanford University
Pacific Grove, California
93950 (408) 373-0464

PROGRAM: GEOPHYSICS

DEGREES OFFERED: B.S. / M.S. / Ph.D.

DESCRIPTION: Geophysics is the branch of earth science concerned with exploration of the earth and its history by physical measurements. The undergraduate and graduate programs are designed to provide (1) a background of fundamentals in science and (2) courses in geophysics to coordinate the fundamentals with principles of geophysics. The program leading to the Bachelor of Science in Geophysics permits many electives and a high degree of flexibility for each individual student. Graduate programs give specialized training for professional work in exploration, in research, and in education.

Current research activities in the department include earthquake prediction studies, studies of geothermal areas, application of seismology to study of present-day tectonics, near field seismology, geophysical monitoring of the San Andreas fault, paleomagnetic investigations, free oscillation and surface wave studies, and major research programs in data analysis techniques and experimental and theoretical rock physics.

NUMBER OF MARINE SCIENCE COURSES: 5

NUMBER OF FACULTY: 14

RESEARCH FACILITIES: The Department of Geophysics is housed in the Ruth Wattis Mitchell Earth Sciences Building and the Salvatori Laboratory of Geophysics. The department has a number of research facilities among which are a seismic observatory, a rock-magnetism laboratory, minicomputers, a high pressure and temperature rock deformation laboratory, and various instruments for field measurements.

CONTACT:

George A. Thompson
School of Earth Sciences
Stanford University

Stanford, California
94305 (415) 497-2300

FOUR-YEAR PRIVATE

UNIVERSITY OF SAN DIEGO

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.A.

DESCRIPTION: USD does not offer an official "biology with marine emphasis" degree program. Their program does, however, prepare the student for future graduate studies in several disciplines, including marine biology.

NUMBER OF MARINE SCIENCE COURSES: 4 undergraduate 0 graduate

NUMBER OF FACULTY: 9

RESEARCH FACILITIES: University of San Diego has no large marine research facilities. However, they maintain several active research laboratories for student and faculty research throughout the year.

CONTACT:

Lou Burnett
Department of Biology
University of San Diego
Alcala Park
San Diego, California
92110 (714) 291-6480 (ext. 4464)

FOUR-YEAR PRIVATE

UNIVERSITY OF SAN FRANCISCO

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: M.S.

DESCRIPTION: The University of San Francisco offers a Master of Science degree in biology with work encompassing the fields of botany, ecology, genetics, invertebrate biology, marine biology, microbiology, physiology, and vertebrate zoology. Each student selects five areas for intensive study: two specialty areas and three auxiliary areas. Marine biology is included in the areas from which a student can choose.

NUMBER OF MARINE SCIENCE COURSES: 3 undergraduate 2 graduate

NUMBER OF FACULTY: 13

RESEARCH FACILITIES: The university has a field vehicle, two small boats with outboard motors, six refrigerated marine aquaria, a cold room, common sampling and field equipment and a physiology laboratory.

CONTACT:

Paul K. Chien
Associate Professor of Marine Biology
University of San Francisco
Biology Department
2130 Fulton Street
San Francisco, California
94117 (415) 666-6531

FOUR-YEAR PRIVATE

UNIVERSITY OF SOUTHERN CALIFORNIA

PROGRAM: BIOLOGICAL SCIENCES (with MARINE SPECIALIZATION)

DEGREE OFFERED: B.S. (with Marine Specialization) / M.S. / Ph.D.

DESCRIPTION: USC offers no official undergraduate "biology with marine emphasis" degree program. However, undergraduates with sufficient desire to concentrate in the field of marine biology can participate in the undergraduate Marine Biology Semester. During the spring semester of their junior or senior year, students take four upper-division elective courses while in residence at the Catalina Marine Science Center. Additional courses in marine biology are taught at the main campus.

Graduate students must choose between two programs of study: The Graduate Program in biology, or the Graduate Program in Molecular Biology. Marine biology is a strong area of specialization in these programs. Graduate courses are offered regularly at the Catalina Laboratory. Special summer courses are offered in addition to the courses offered during the school year.

NUMBER OF MARINE SCIENCE COURSES: 8 undergraduate 5 graduate (10 graduate courses offered at Catalina)

NUMBER OF FACULTY: 72

RESEARCH FACILITIES: Through the Institute for Marine and Coastal Studies (IMCS), field work in the marine sciences in virtually every environment is possible at the Catalina Marine Science Center at Fisherman's Cove, on Santa Catalina

Island, and aboard the research vessel, Velero IV, located at the Institute's Marine Support Facility in Wilmington. The Velero IV is a well-equipped floating laboratory with a crew of 11 and space for 12 scientists for extended cruises. Also at the Marine Support Facility are the Sea Watch, a 65-foot boat equipped for supporting up to 60 marine science students and faculty for short cruises; the 37-foot Golden West, equipped for diving support and nearshore sampling; a 28-foot high-speed commuting launch; and several smaller craft for inshore collecting and observation.

The Allan Hancock Foundation contains specialized laboratories for oceanographic studies. It also houses the Allan Hancock Library, which includes over 80,000 volumes and well over 100,000 reprints in the oceanographic field. The Hancock taxonomic collection is one of the finest working libraries of marine flora and fauna in the United States.

CONTACT:

David N. Young
Professor of Marine Biology
Allan Hancock Foundation
University of Southern California
University Park
Los Angeles, California
90007 (213) 741-7069
or (213) 741-2928

PROGRAM: GEOLOGICAL SCIENCES (with MARINE EMPHASIS)

DEGREE OFFERED: M.S. / Ph.D.

DESCRIPTION: The University of Southern California does not offer an oceanography degree program at the undergraduate level, since the department believes that specialized work in the field should be based on a sound preparation in a traditional field such as mathematics, science, or engineering. USC offers a general science service course in oceanography for non-science undergraduates, as well as an upper-division course in introductory oceanography for students in their senior year of geology who plan to enter graduate study in marine science.

At the graduate level, USC's Department of Geological Sciences offers a graduate program in geological sciences with strong areas of specialization in marine geology, geochemistry, geophysics, and physical oceanography. All degrees are in geological sciences, but course programs, theses, and dissertation research are in marine science areas. Approximately half of the Ph.D.'s awarded in geological sciences in the last 43 years have been in marine geological subjects. major areas include dynamics of marine sediment transport, marine sedimentary environmental studies, coastal dynamics, water and sediment chemistry, isotopic studies, shelf and basin water circulation, heat flow, crustal structure and seismic-stratigraphic studies of marine basins, and apaleoecologic and microfaunal studies of shelf and deep-sea environments.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate 11 graduate

NUMBER OF FACULTY: 18 (6 specifically marine)

RESEARCH FACILITIES: Field work is done aboard the vessels of the Institute for Marine and Coastal Studies and from small craft using diving equipment. Campus laboratories for sediment analysis, isotopic studies of water and sediments, general marine geochemical analysis, geophysical analysis, data recording and reduction, and paleoecologic analysis are devoted to graduate study and advanced research. Equipment for marine geologic field work, geophysical surveying and water and sediment sampling is maintained at the USC Marine Facility. Deep-sea work is done aboard the research vessel Velero IV, and the research vessels Sea Watch and Golden West are used for shallow water coastal work and diver support.

(For additional information, see page 76).

CONTACT:

Donn S. Gorsline
Professor of Marine Geology
Department of Geological Sciences
University of Southern California

Los Angeles, California
90007 (213) 741-2920

PROGRAM: MARINE POLICY

DEGREE OFFERED: M.A. / Ph.D.

DESCRIPTION: The University of Southern California has a newly-developed joint graduate program leading to a Master of Arts in marine policy, through the Institute of Marine and Coastal Studies and the School of Public Administration. A program leading to both M.A. and Ph.D. degrees in marine policy with emphasis in seaport management, marine transportation, coastal zone management or international ocean policy is expected to commence in 1980 or 1981.

NUMBER OF MARINE SCIENCE COURSES: Not applicable

NUMBER OF FACULTY: 4

RESEARCH FACILITIES: See description on page 76.

CONTACT:

Robert Friedheim
Institute of Marine and Coastal Studies
University of Southern California
University Park
Los Angeles, California
90009 (213) 741-6840

PROGRAM: OCEAN ENGINEERING

DEGREE OFFERED: M.S.

DESCRIPTION: University of Southern California offers a Master of Science degree program in ocean engineering. The program is directed toward preparing students for a professional career in ocean-oriented engineering activities. The program is interdisciplinary and flexible to satisfy the needs of students with a variety of backgrounds.

Three possible fields of specialization within the degree program are ocean dynamics, coastal engineering, and structures. Other areas which could be emphasized include ocean communications, systems, design, public administration, system safety, and marine pollution. The program is interdisciplinary, featuring faculty, staff, and courses from many engineering departments and from the Institute for Marine and Coastal Studies.

NUMBER OF MARINE SCIENCE COURSES: 21 undergraduate and graduate courses in ocean engineering and related areas.

NUMBER OF FACULTY: Not applicable--Interdisciplinary program

RESEARCH FACILITIES: USC's facilities include wave tanks, specially designed stratified flow channels, and a special channel for sediment transportation studies. The Institute for Marine and Coastal Studies has oceanographic

vessels which offer instrumentation experience, and a facility at Santa Catalina Island.

CONTACT:

Fred K. Browand
Department of Aerospace Engineering
OHE 330
University of Southern California
University Park
Los Angeles, California
90007 (213) 741-2035

FOUR-YEAR PUBLIC COLLEGES AND UNIVERSITIES

FOUR-YEAR PUBLIC

CALIFORNIA MARITIME ACADEMY

PROGRAM: MARINE ENGINEERING TECHNOLOGY (with OCEAN TECHNOLOGY OPTION)

DEGREE OFFERED: B.S.

DESCRIPTION: The Marine Engineering Technology Program gives students the necessary background in marine propulsion systems and the other engineering systems aboard ship to qualify them for the engineering licenses: steam-unlimited horse power, and diesel-unlimited horse power. After graduation, the marine engineering technology student is fitted not only for service as an engineer aboard ship but also for employment as an engineering technologist in a wide range of industries ashore. The education is much like that of the mechanical engineering technology curriculum offered in other colleges.

The marine engineering technology major with an ocean technology option requires an additional 16 semester units of marine science courses. Sample courses include Oceanography I and II, Oceanic Instruments and Vessels, Ocean Engineering, Marine Biology, and Nearshore and Estuarine Processes.

NUMBER OF MARINE SCIENCE COURSES: 18 undergraduate (units) 0 graduate

NUMBER OF FACULTY: 10

RESEARCH FACILITIES: The academy is adjacent to the Carquinez Strait, where a deep-water pier provides berthing space for the training ship Golden Bear. The Golden Bear is a 7,987 gross-ton vessel which can cruise at 16 knots, and

serves as a "floating laboratory" during annual training cruises and during the campus trimesters.

CONTACT:

Commander Otto Bruhn
Chief Engineer of Training Ship Golden Bear
and Head of Marine Engineering Technology Department

or

Mr. Art Behm, First Assistant
Training Ship Golden Bear

or

Jack Dean, Second Assistant
Training Ship Golden Bear
California Maritime Academy
P.O. Box 1392
Vallejo, California
94590 (707) 644-5601

PROGRAM: NAUTICAL INDUSTRIAL TECHNOLOGY

DEGREE OFFERED: B.S.

DESCRIPTION: The student aspiring to a career as a licensed deck officer majors in Nautical Industrial Technology. This title is used for the deck program because the deck curriculum embodies the two major aspects of industrial technology programs taught at other colleges; namely, a technology concentration and a management concentration. For the N.I.T. program the technology concentration consists of seamanship, navigation, ship operation, cargo handling and nautical rules of the road. The deck officer must master the above to meet his immediate responsibilities as a mate. A mate is also a manager aboard the ship. Mates rise to the position of Captain or Master of the ship. The Master is the commanding or managing officer of the ship. After considerable experience at sea, mates are often given the opportunity to serve ashore in a shipping company or related maritime industry in a management capacity. It is for these reasons that management is the second emphasis in the Nautical Industrial Technology Curriculum.

The Nautical Industrial Technology program is designed to give the student the necessary background in navigation, seamanship, cargo handling and rules for all grades of license up to and including Master. After the requisite experience it is a comparatively simple matter for an Academy graduate to review his studies, integrate his experience and successfully undertake the examinations for the successively higher

licenses.

NUMBER OF MARINE SCIENCE COURSES: 18 undergraduate (units) 0 graduate

NUMBER OF FACULTY: 10

RESEARCH FACILITIES: See pages 84 and 85

CONTACT:

John M. Keever, Commander, CMA
California Maritime Academy
Box 1392
Vallejo, California
94590 (707) 644-5601

FOUR-YEAR PUBLIC

CALIFORNIA POLYTECHNIC STATE UNIVERSITY
SAN LUIS OBISPO

PROGRAM: BIOLOGICAL SCIENCES with MARINE BIOLOGY CONCENTRATION

DEGREE OFFERED: B.S. / M.S.

DESCRIPTION: The university offers both the Bachelor of Science and the Master of Science degrees with curricular choices in concentrations such as marine biology. Besides offering the student a broad education in the biological sciences, this concentration is suitable for preprofessional preparation in the biomedical fields, as a base for work toward postbacculaureate studies and for technical competence in marine biology. Students electing this concentration may look forward to occupational and professional work in the field of oceanographic enterprises and studies.

NUMBER OF MARINE SCIENCE COURSES: 7 undergraduate 1 graduate

NUMBER OF FACULTY: 50

RESEARCH FACILITIES: A marine biology laboratory with recirculating sea water is maintained in the Science North building on campus and water tables are available for graduate students. An algal collection is part of the herbarium. Basic collecting and dredging gear, as well as several small boats and a 17-foot dory, are provided for field work. A radioactive chromatograph scanner, an X-ray diffraction machine and liquid scintillation apparatus may be used by marine sciences students for radioactive tracer studies. Other pertinent equipment includes a Leitz micro-manipulator, a

transmission electron microscope and a scanning electron microscope, a Leitz orthomat for automatic photomicrography, recording spectrophotometer (UV through visible), gas chromatography apparatus, fraction collectors, ultra-centrifuge, densitometers, fluormeter and high voltage electrophoresis and atomic absorption equipment. Several controlled growth chambers and a dew chamber are also available. The department shares the use of an IBM 360 computer with 128K core storage units.

CONTACT:

David H. Montgomery
Biological Sciences Department
California Polytechnic State University
San Luis Obispo, California
93407 (805) 546-2446

FOUR-YEAR PUBLIC

CALIFORNIA STATE COLLEGE, STANISLAUS

PROGRAM: BIOLOGY with MARINE CONCENTRATION

DEGREE OFFERED: B.A. / B.S.

DESCRIPTION: CSC, Stanislaus offers both a Bachelor of Arts and a Bachelor of Science degree program in the biological sciences with concentration in marine biology. The Bachelor of Arts degree is designed to provide breadth and background in the natural sciences and to allow sufficient flexibility to accommodate the diverse needs of the general student. Individuals preparing for careers in agriculture, industry, and elementary or secondary teaching will find that this degree is adaptable to their career objectives. The Bachelor of Science is designed to provide the comprehensive background in the sciences required for students planning to attend graduate or professional schools.

The marine biology option is one of several options offered by the biological sciences department. Completing a concentration is optional, and students should confer with their departmental advisor to determine which degree is best suited to their marine science objective. Students interested in marine biology and oceanography may elect course work at the Moss Landing Marine Laboratories for partial fulfillment of their in-resident major and degree requirements.

NUMBER OF MARINE

SCIENCE COURSES: 5 undergraduate (25 at MLML) 0 graduate (22 at MLML)

NUMBER OF FACULTY: 11

RESEARCH FACILITIES: CSC, Stanislaus is a member of the California State University and College consortium that operates the Moss Landing Marine Laboratories at Moss Landing, California. This facility functions as a seaside extension of the cooperating campuses (Stanislaus, Fresno, Hayward, Sacramento, San Francisco, and San Jose), and offers course work in marine biology, geology, meteorology, oceanography, and other marine sciences. The curriculum is designed to fulfill major requirements for qualified upper-division and graduate students. Such students can plan their academic schedules to provide for one or more terms at the Moss Landing Marine Laboratories and will be considered an in-residence student at CSC, Stanislaus. See also description of MLML on page 161.

CONTACT:

Pamela Roe
Associate Professor of Biology
Biology Department
California State College, Stanislaus
Turlock, California
95380 (209) 633-2484
or (209) 633-2476

FOUR-YEAR PUBLIC

CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

PROGRAM: OCEAN ENGINEERING MINOR

DEGREE OFFERED: (part of baccalaureate)

DESCRIPTION: Cal Poly, Pomona offers a degree minor program in ocean engineering. Students in the aerospace, electrical and electronics, civil, chemical, industrial/-manufacturing, and mechanical engineering disciplines can receive a minor in ocean engineering, in addition to the regular B.S. engineering degree. To obtain the minor, students must complete a minimum of 24 units from selected courses, including required courses in ocean engineering, underwater electronics, hydronautics, and oceanography. Students must take a course in either offshore structures, hydrospace structures, control and monitoring systems for undersea work vehicles, or coastal engineering. The remaining units may be selected from courses including skin and scuba diving, introduction to NAUTILUS instrumentation, hydrospace laboratory, introduction to marine biology, marine ecology, ichthyology, soil mechanics, pollution abatement, corrosion chemistry, or welding fabrication and design.

The senior project, required of all engineering students, must be done in ocean engineering.

NUMBER OF MARINE SCIENCE COURSES: 14 undergraduate 0 graduate

NUMBER OF FACULTY: 8

RESEARCH FACILITIES: Cal Poly, Pomona is a member of the Southern California Ocean Studies Consortium. See description under CSU, Long Beach's biology program, on page 104.

Housed in the School of Engineering complex is a wave-making tank, a circular towing basin, a water tower, and a ling electrodynamic shaker. To support research using these facilities is a full complement of electronic instrumentation, and mechanical test equipment. Also in the complex is a large and fully equipped machine shop for ocean project activities.

As a feature of the ocean engineering program, a continuing ocean project activity has been initiated. This will carry out special ocean engineering projects of a research, development, or instructional nature.

CONTACT:

John McMillan
Department of Ocean Engineering
California State Polytechnic University
3801 West Temple Avenue
Pomona, California
91768 (714) 598-4337
or (714) 598-4311

FOUR-YEAR PUBLIC

CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS

PROGRAM: MINOR IN EARTH AND MARINE SCIENCES

DEGREE OFFERED: (part of baccalaureate degree)

DESCRIPTION: CSU, Dominguez Hills offers a minor in earth and marine sciences to provide non-science majors with a knowledge of the principles of science and its application to the areas of geology, oceanography, and physical geology. A total of 28 units is required, and typical courses include those in general geology, historical geology; mineralogy; igneous and metamorphic petrology; physical, chemical and biological oceanography; paleontology; geomorphology; weather; maps, photographs and remote sensing; and environmental problems.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate 0 graduate

NUMBER OF FACULTY: 5

RESEARCH FACILITIES: CSU, Dominguez Hills is a member of the Southern California Ocean Studies Consortium that has access to research vessels for marine studies. See description under CSU, Long Beach, on page 104.

CONTACT:

Francis McCarthy
Professor of Marine Sciences

California State University, Dominguez Hills
Carson, California.
90747 (213) 515-3413

102

PROGRAM: MINOR IN MARINE SCIENCE

DEGREE OFFERED: (part of baccalaureate degree)

DESCRIPTION: CSU, Dominguez Hills offers a minor in marine science as a complement to any major, especially that of biology, chemistry, physics, or geography. The minor is useful for students who want to go on to graduate studies in marine science or oceanography, or for students who want to major in science or mathematics.

Twenty-eight units of course credit are required for the minor. Some of the required courses include courses in general geology, historical geology; physical, chemical and biological oceanography; marine ecology, geology, and chemistry; and paleontology.

NUMBER OF MARINE SCIENCE COURSES: 5 undergraduate 0 graduate

NUMBER OF FACULTY: 5

RESEARCH FACILITIES: CSU, Dominguez Hills is a member of the Southern California Ocean Studies Consortium that has access to vessels for marine studies. See description under CSU, Long Beach on page 104.

CONTACT:

Francis McCarthy
Professor of Marine Sciences
California State University, Dominguez Hills
Carson, California
90747 (213) 515-3413

FOUR-YEAR PUBLIC

CALIFORNIA STATE UNIVERSITY, FRESNO

PROGRAM: BIOLOGY with options in ENVIRONMENTAL BIOLOGY, ZOOLOGY and BIOLOGICAL SCIENCE

DEGREE OFFERED: B.A.

DESCRIPTION: CSU, Fresno offers a degree program in biology with several options appropriate to studies in marine science. The biology degree provides the required specialization for entering graduate schools, professional schools, or vocations requiring a biological background. Three options--biological science, zoology, and environmental biology--provide the flexibility and breadth needed to permit development of marine science within the biology degree program. All three options provide a background leading to graduate study; biological science is most associated with preparation for teaching, while zoology and environmental biology are more suitable for careers in fish and game research and management.

The marine science emphasis is made possible through course work taken at Moss Landing Marine Laboratories. Students at CSU, Fresno receive resident (home campus) credit for courses taken at Moss Landing.

NUMBER OF MARINE SCIENCE COURSES: 6 undergraduate (25 at MLML) 0 graduate (24 at MLML)

NUMBER OF FACULTY: 28

RESEARCH FACILITIES: CSU, Fresno is one of the six California State Colleges and Universities operating the Moss Landing Marine Laboratories. This facility offers full-time course work in marine biology, oceanography, and other marine sciences. The curriculum offered at Moss Landing is designed to support majors in biological and physical sciences through course offerings which may be incorporated into those of the biology, chemistry, and geology degree requirements. See description of Moss Landing Marine Laboratories under San Jose State University on page 161.

CONTACT:

Keith H. Woodwick
Professor of Biology
California State University
Fresno, California
93740 (209) 487-2497
or (209) 487-2001

FOUR-YEAR PUBLIC

CALIFORNIA STATE UNIVERSITY, FULLERTON

PROGRAM: BIOLOGY with MARINE EMPHASIS

DEGREE OFFERED: B.A. / M.A.

DESCRIPTION: CSU, Fullerton offers Bachelor of Arts and Master of Arts degree programs in biology with emphasis in marine biology. The programs are designed for students preparing to enter graduate or professional schools, for those preparing to teach, and for those preparing for careers in industry or government service.

The marine science programs emphasize the nearshore environment and include active field and laboratory instruction in the biology and ecology of coastal marine plankton, benthic macro-algae and invertebrates, and fishes. Students seeking the Bachelor of Arts degree should construct a program of course work consistent with career objectives in consultation with an advisor. For the Master of Arts degree, advisor-approved graduate course work, a research thesis, and a final oral examination are required.

NUMBER OF MARINE SCIENCE COURSES: 9 undergraduate 1 graduate

NUMBER OF FACULTY: 28

RESEARCH FACILITIES: The Department of Biological Science occupies two floors of the Science Building and an adjacent greenhouse complex. Research facilities include and electron microscope and preparation area, modern compound and inverted microscopes, controlled environmental

chambers, and aquaria rooms. Collections of algae and invertebrates are also available.

CSU, Fullerton is a founding member of the Southern California Ocean Studies Consortium (SCOSC) which provides research and classroom facilities aboard the research vessel Nautilus, a converted 52-foot purse-seiner berthed nearby in Long Beach Harbor. See description under CSU, Long Beach on page 104.

CONTACT:

Steven N. Murray
Department of Biological Science
California State University
Fullerton, California
92634 (714) 773-3614

or

Michael H. Horn
Department of Biological Science
California State University
Fullerton, California
92634 (714) 773-3614

or

Roger R. Seapy
Department of Biological Science
California State University
Fullerton, California
92634 (714) 773-3614

FOUR-YEAR PUBLIC

CALIFORNIA STATE UNIVERSITY, HAYWARD

PROGRAM: BIOLOGY with ENVIRONMENTAL AND PHYSIOLOGICAL OPTIONS

DEGREE OFFERED: M.S.

DESCRIPTION: CSU, Hayward offers the Master of Science degree in biological science with options in the fields of environmental biology (general ecology, vertebrate and invertebrate ecology, marine ecology, limnology, insect ecology, plant ecology, or physiological ecology) and physiological biology (cell physiology and biology, plant and animal physiology, or microbial physiology).

Students working toward an M.S. degree utilizing marine organisms may take courses both on the home campus and at the Moss Landing Marine Laboratories. Both facilities offer a variety of courses in marine biology and oceanography. Qualified graduate students may enroll in courses at both Hayward and Moss Landing and earn CSUH resident credit for such course work.

NUMBER OF MARINE SCIENCE COURSES: 10 undergraduate 8 graduate (20 at MLML)

NUMBER OF FACULTY: 10

RESEARCH FACILITIES: The CSU, Hayward Department of Biological Science has modern facilities and equipment for both field and laboratory work in marine biology. The close proximity to the shores of San Francisco Bay provides ample opportunity for field studies in estuarine environments such as salt marshes and intertidal mud flats.

CSU, Hayward is one of the six cooperating state universities that offer courses and research at the Moss Landing Marine Laboratories, owned and operated by the California State University and College System. The facility functions as a seaside extension of the six campuses and is equipped for field studies in marine biology, oceanography, and other marine sciences.

CONTACT:

Edward B. Lyke, Chairman
Department of Biological Sciences
California State University
Hayward, California
94542 (415) 881-3471

FOUR-YEAR PUBLIC

CALIFORNIA STATE UNIVERSITY, HAYWARD (cont.)

PROGRAM: EARTH SCIENCES with OPTION IN ENVIRONMENTAL GEOLOGY

DEGREE OFFERED: M.S.

DESCRIPTION: CSU, Hayward offers a Master of Science degree program in earth sciences with option in environmental geology. The program is designed to prepare students for, among other things, doctoral research in the environmental aspects of geology, geochemistry, geophysics, geomorphology, and oceanography, depending upon undergraduate backgrounds.

Students working toward an M.S. in the earth sciences may take courses offered at the Moss Landing Marine Laboratories (MLML). The facility offers full-time course work in marine geology, oceanography, and other marine-related earth sciences. Qualified graduate students may enroll for a term of instruction at Moss Landing and earn resident credit for such course work.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate (9 at MLML) 2 graduate (2 at MLML)

NUMBER OF FACULTY: 12

RESEARCH FACILITIES: See description under CSU, Hayward, on page 100.

See also the description of MLML, under San Jose State University, on page 161.

CONTACT:

Detlef A. Warnke
Department of Geological Sciences
California State University
Hayward, California
94542 (415) 881-3486

FOUR-YEAR PUBLIC

CALIFORNIA STATE UNIVERSITY, LONG BEACH

PROGRAM: BIOLOGY with MARINE OPTION

DEGREE OFFERED: M.S.

DESCRIPTION: CSU, Long Beach offers a Master of Science degree program in biology with an option in marine biology. Courses for the degree program are selected in consultation with an assigned advisor. Because the campus is near the ocean, the department is able to offer a number of field and laboratory courses in marine biology. The biology department also participates in the interdisciplinary Center for Ocean Science Studies, which provides opportunities for graduate studies in the coastal environment.

NUMBER OF MARINE SCIENCE COURSES: 10 undergraduate 2 graduate

NUMBER OF FACULTY: 10 specifically marine

RESEARCH FACILITIES: The biology department occupies facilities in three science buildings, which house an electron microscope, a seawater system, greenhouses, and research and teaching collections of algae, fungi, vascular plants, invertebrates, and vertebrates.

CSU, Long Beach is a member of the Southern California Ocean Studies Consortium (SCOSC), which offers special courses in ocean studies. The SCOSC operates the research vessel Nautilus, a 50-foot purse seiner type vessel. The Nautilus is owned by the SCOSC, and it provides onboard research laboratories and classroom facilities.

CONTACT:

Charles Galt
Department of Biology
California State University
1250 Bellflower Boulevard
Long Beach, California
90840 (213) 498-4808
or (213) 498-4806

PROGRAM: GEOLOGY with MARINE EMPHASIS

DEGREE OFFERED: B.S. / M.S. (with Marine Emphasis)

DESCRIPTION: CSU, Long Beach offers a Bachelor of Science degree program in geology with marine emphasis. Students considering this program must obtain a departmental advisor to help plan a four-year program that reflects a strong marine geology basis. The Master of Science program is unofficial and must be planned with the faculty. The geological sciences department participates in the interdisciplinary Center for Ocean Science Studies, which offers a variety of courses suitable for the student interested in marine geology.

NUMBER OF MARINE SCIENCE COURSES: 3 undergraduate 2 graduate

NUMBER OF FACULTY: 10

RESEARCH FACILITIES: The geological sciences department is a member of the Center for Ocean Science Studies, described in the program description for CSU, Long Beach on page 104.

CONTACT:

Bert L. Conrey
Department of Geological Sciences
1250 Bellflower Boulevard
California State University
Long Beach, California
90840 (213) 498-4818

PROGRAM: MARINE BIOLOGY

DEGREE OFFERED: B.S.

DESCRIPTION: CSU, Long Beach offers a Bachelor of Science degree program in marine biology. Courses for the degree program are selected in consultation with an assigned major advisor. The student majoring in marine biology can select elective courses that provide additional emphasis in marine biology, or another field of biology, such as biosystematics, ecology, genetics, morphology, or plant or animal physiology. Courses are offered in several areas of experimental biology. Because the campus is near the ocean, the department is able to offer a number of field and laboratory courses in marine biology. The biology department also particiaptes in the interdisciplinary Center for Ocean Science Studies, which provides opportunities for undergraduate and graduate studies in the coastal environment.

NUMBER OF MARINE SCIENCE COURSES: 10 undergraduate 2 graduate

NUMBER OF FACULTY: 10 specifically marine

RESEARCH FACILITIES: The biology department occupies facilities in three science buildings, which house two electron microscopes, a seawater system, greenhouses, and research and teaching collections of algae, fungi, vascular plants, invertebrates, and vertebrates.

CSU, Long Beach is a member of the Southern California Ocean Studies Consortium (SCOSC), which offers special courses in ocean studies. The SCOSC operates the research vessel Nautilus, a 50-foot purse seiner type vessel. The Nautilus is owned by the SCOSC, and it provides onboard research laboratories and classroom facilities.

CONTACT:

Charles Galt
Department of Biology
California State University
1250 Bellflower Boulevard
Long Beach, California
90840 (213) 498-4808
or (213) 498-4806

PROGRAM: OCEAN ENGINEERING

DEGREE OFFERED: B.S.

DESCRIPTION: CSU, Long Beach offers a Bachelor of Science degree program in ocean engineering. The ocean engineering program is designed to provide students with two basic skills: (1) a competence in one of three basic engineering disciplines (civil, electrical, or mechanical), and (2) an understanding of the ocean environment and knowledge of the drastic effects this environment can have upon engineering endeavors.

The curriculum is built around a strong basic core of mathematics, physics, and engineering science. This is followed by more advanced courses in electronics, analytical mechanics, fluid mechanics, thermodynamics, materials and corrosion, ocean environment, and underwater systems. A wide choice of elective units permits a degree of specialization in a traditional engineering discipline plus further exploration into ocean-related academic areas.

NUMBER OF MARINE SCIENCE COURSES: 15 undergraduate 1 graduate

NUMBER OF FACULTY: Not applicable--interdepartmental program

RESEARCH FACILITIES: The electrical engineering department participates in the Southern California Ocean Studies Consortium of the California State University and Colleges system (SCOSC), described in the program description for CSU, Long Beach on page 104.

CONTACT:

Captain L. Boyd Kendall
Department of Electrical Engineering
California State University
1250 Bellflower Boulevard
Long Beach, California
90840 (213) 498-428?
or (213) 498-5102

or

Ocean Engineering Coordinator
Department of Electrical Engineering
California State University
1250 Bellflower Boulevard
Long Beach, California
90840 (213) 498-5102

FOUR-YEAR PUBLIC

CALIFORNIA STATE UNIVERSITY, LOS ANGELES

PROGRAM: BIOLOGY with ENVIRONMENT OPTION

DEGREE OFFERED: B.S.

DESCRIPTION: CSU, Los Angeles offers a Bachelor of Science degree program in biology with an option in environmental biology. The biology degree is intended to provide the rigorous training necessary for those wanting to become professional biologists, to pursue graduate work, or to attend professional schools, while allowing some flexibility in the courses taken. The option in environmental biology is intended for students who are interested in the environmental aspects of biology.

Students enrolled in the environmental option program select courses from several areas of science, including engineering, geography, geology, oceanography, meteorology, biology, ecology, natural history, and natural resources, as well as courses in English and economics. Students can choose from a wide selection of marine science courses, including those in oceanography, ichthyology, marine invertebrate zoology, freshwater and marine botany, conservation of wildlife, population ecology, marine zoology, and algae.

NUMBER OF MARINE SCIENCE COURSES: 7 undergraduate 4 graduate

NUMBER OF FACULTY: 24

RESEARCH FACILITIES: CSU, Los Angeles is a member of the Southern California Ocean Studies Consortium. See description under CSU, Long Beach, on page 104.

CONTACT:

Wayne Alley
Department of Biology
California State University
5151 State University Drive
Los Angeles, California
90032 (213) 224-3386
or (213) 224-2843

FOUR-YEAR PUBLIC

CALIFORNIA STATE UNIVERSITY, SACRAMENTO

PROGRAM: BIOLOGICAL SCIENCES (Biological Conservation) (with MARINE EMPHASIS)

DEGREE OFFERED: M.S.

DESCRIPTION: CSU, Sacramento does not offer an official "biology with marine emphasis" degree program. However, one option of the biology program focuses on biological conservation, and requires a bachelor's degree in biology with specialty in zoology, ecology, fishery biology, or wildlife biology for admission.

Each student designs a specific curriculum with an advisor, and students interested in marine biology can take courses offered at Moss Landing Marine Laboratories for credit toward the major.

NUMBER OF MARINE SCIENCE COURSES: 5 undergraduate (25 at MLML) 2 graduate (23 at MLML)

NUMBER OF FACULTY: 29

RESEARCH FACILITIES: See descriptions of Moss Landing Marine Laboratories on pages 156 and 161.

CONTACT:

Martin Brittan
Professor of Biology
Department of Biological Sciences
California State University
6000 J Street
Sacramento, California
95819 (916) 454-6244
or (916) 454-6535

PROGRAM: BIOLOGICAL SCIENCES (with MARINE EMPHASIS)

DEGREE OFFERED: M.A.

DESCRIPTION: CSU, Sacramento does not offer an official "biology with marine emphasis" degree program. However it is possible to design a specific curriculum with an advisor, and students interested in marine biology can take courses offered at Moss Landing Marine Laboratories for credit toward the major.

NUMBER OF MARINE SCIENCE COURSES: 5 undergraduate (25 at MLML) 2 graduate (23 at MLML)

NUMBER OF FACULTY: 29

RESEARCH FACILITIES: See description of Moss Landing Marine Laboratories on pages 156 and 161.

CONTACT:

Martin Brittan
Professor of Biology
Department of Biological Sciences
California State University
6000 J Street
Sacramento, California
95819 (916) 454-6244
or (916) 454-6535

FOUR-DEGREE PUBLIC

CALIFORNIA STATE UNIVERSITY, SACRAMENTO

PROGRAM: BIOLOGICAL SCIENCES with MARINE BIOLOGY--LIMNOLOGY EMPHASIS (aquatic biology)

DEGREE OFFERED: B.A.

DESCRIPTION: CSU, Sacramento offers a Bachelor of Arts degree program in biological science with emphasis in marine biology-limnology (aquatic biology). Students take a biology preparatory program that includes core subjects such as basic biological concepts, animal biology, plant biology, physiology, microbiology, ecology, and genetics; supporting subjects in chemistry, physics, and statistics; and a minimum of 9 units selected from courses including invertebrate zoology, limnology, ichthyology, marine ecology, vertebrate zoology, and general oceanography (offered by the Geological Sciences Department).

NUMBER OF MARINE SCIENCE COURSES:

4 undergraduate	0 graduate
(25 at MLML)	(23 at MLML)

NUMBER OF FACULTY: 29

RESEARCH FACILITIES: CSU, Sacramento is one of the six participating state universities and colleges offering full-time course work at the Moss Landing Marine Laboratories. Students can take courses in marine biology, oceanography, marine geology, and other marine sciences offered at the facility. See description of MLML under San Jose State University, on page 149.

CONTACT:

Martin Brittan
Professor of Biology
Department of Biological Sciences
California State University
6000 J Street
Sacramento, California
95819 (916) 454-6244
or (916) 454-6535

PROGRAM: BIOLOGY with ENVIRONMENTAL CONCENTRATION

DEGREE OFFERED: B.A.

DESCRIPTION: CSU, Sacramento offers a Bachelor of Arts degree program in biological science with concentration in environmental biology. Although the environmental biology option does not offer a marine biology emphasis, students can take courses offered by Moss Landing Marine Laboratories to augment their environmental option with marine studies. See description of MLML under San Jose State University, on page 159.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate (25 at MLML) 0 graduate (23 at MLML)

NUMBER OF FACULTY: 29

RESEARCH FACILITIES: CSU, Sacramento is one of the six participating state universities and colleges offering full-time course work at the Moss Landing Marine Laboratories. Students can take courses in marine biology, oceanography, marine geology, and other marine sciences offered at the facility. See description of MLML under San Jose State University, on page 161.

CONTACT:

Martin Brittan
Professor of Biology
Department of Biological Sciences
California State University
6000 J Street
Sacramento, California
95819 (916) 454-6244
or (916) 454-6535

PROGRAM: GEOLOGY (with OCEANOGRAPHY EMPHASIS)

DEGREE OFFERED: B.S.

DESCRIPTION: CSU, Sacramento offers no official "geology with marine emphasis" degree program. However, students interested in oceanography can design a program using courses offered at Moss Landing Marine Laboratories. Students interested in this individual program must seek a faculty advisor to help formulate a program that shows a strong oceanography basis.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate (9 at MLML) 0 graduate (7 at MLML)

NUMBER OF FACULTY: 6

RESEARCH FACILITIES: See description of Moss Landing Marine Laboratories on pages 156 and 161.

CONTACT:

David McGeary, Chairman
and Professor of Geology
Department of Geology
California State University
Sacramento, California
95819 (916) 454-6337
or (916) 454-6667

FOUR-YEAR PUBLIC

HUMBOLDT STATE UNIVERSITY

PROGRAM: BIOLOGY with MARINE SPECIALIZATION

DEGREE OFFERED: B.A. / M.A.

DESCRIPTION: Humboldt does not offer an official "biology with specialization in marine biology" degree program. However, students in the biology program can choose from a broad range of courses, including several courses in marine biology. Such courses include Invertebrate Zoology, Intertidal Ecology, Benthic Ecology, Marine Phycology, and numerous courses offered by the fisheries and oceanography departments.

NUMBER OF MARINE SCIENCE COURSES: 7 (not ranked by graduate or undergraduate)

NUMBER OF FACULTY: 6 (biologists interested in the marine area)

RESEARCH FACILIITIES: Humboldt has facilities for research both on the main campus and at the Telonicher Marine Sciences Laboratory in Trinidad, on the coast 15 miles north of the campus. Boats available for student research include a 26-foot pontoon boat for protected waters, a 23-foot offshore dory for open ocean waters, and an assortment of smaller boats for bays and lakes. The University is in the process of acquiring a 130-foot research vessel for ocean field courses.

Equipment and instrumentation necessary for research are available both on campus and at the marine laboratory, and include trawls, plankton nets, NIO bottles, bottom grabs and corers, centrifuges, spectrophotometers, conductivity meters, and isotope counting instruments.

CONTACT:

James P. Smith, Chairman
Department of Biology
Humboldt State University
Arcata, California
95521 (707) 826-3245

or

John DeMartini, Director
Fred Telonicher Marine Laboratory
P.O. Box 624
Trinidad, California
95570 (707) 677-3671

PROGRAM: ENVIRONMENTAL RESOURCE ENGINEERING with OCEAN AND COASTAL EMPHASIS

DEGREE OFFERED: B.S.

DESCRIPTION: Humboldt offers and ocean and coastal engineering emphasis within the environmental resource engineering degree program. The engineering department requires students to design a natural resources- or environment-oriented engineering program, in consultation with their advisors.

NUMBER OF MARINE SCIENCE COURSES: 6 undergraduate 0 graduate

NUMBER OF FACULTY: 10

RESEARCH FACILITIES: Students enrolled in the engineering with ocean and coastal engineering emphasis program can get instrumentation experience aboard the vessels available through Humboldt's marine laboratory in Trinidad. A complete water quality laboratory is available in the engineering department. Field monitoring equipment is also available.

See additional description on page 121.

CONTACT:

Bob Gearheart, Chairman
Department of Engineering
Humboldt State University
Environmental Resources Engineering Department
Room 115, Engineering Building
Arcata, California
95521 (707) 826-3135

or

Al Burrows
Professor of Engineering
Humboldt State University
Environmental Resources Engineering Department
Arcata, California
95521 (707) 826-3618

PROGRAM: FISHERIES (with MARINE SPECIALIZATION)

DEGREE OFFERED: B.S. / M.S.

DESCRIPTION: Humboldt offers an undergraduate and a graduate degree program in fisheries. The program is designed to allow students to emphasize either freshwater or marine fishes through choices in restrictive elective categories and a 20-unit free elective program. Courses available for a marine fisheries emphasis include Oceanography, Ecology of Marine Fishes, Marine Botany, and invertebrate courses, Dynamics of Marine Primary Production, Mariculture, Early Life History of Marine Fishes, and Fish Population Dynamics.

NUMBER OF MARINE SCIENCE COURSES: 6 primarily marine; 7 marine and freshwater (not divided into graduate or undergraduate)

NUMBER OF FACULTY: 5 (members of the department interested in marine fishes)

RESEARCH FACILITIES: See description on page 121.

Specialized facilities are available for fisheries instruction and research. These include a freshwater fish hatchery and associated rearing ponds, raceways, spawning pens, and an artificial stream. Salt water aquaria with capacities of up to 500 gallons are located both on campus and at the marine laboratory located in Trinidad. Facilities also include a fish pathology laboratory and a toxicity bioassay area. An anadromous salmonid fish culture facility utilizing

domestic wastewater and seawater is located at the City of Arcata sewage treatment plant on Humboldt Bay.

CONTACT:

George Allen, Chairman
Department of Fisheries
Humboldt State University
Arcata, California
95521 (707) 826-3951

PROGRAM: INTERDISCIPLINARY STUDIES in NATURAL RESOURCES with an OCEANOGRAPHY OPTION

DEGREE OFFERED: M.S.

DESCRIPTION: Humboldt offers a graduate program in interdisciplinary studies in natural resources with an oceanography option. To complete the program, students must have an undergraduate degree in either the natural resources, a life science, or a physical science. Students choose from numerous marine science courses offered by the biology, oceanography, and fisheries departments.

NUMBER OF MARINE SCIENCE COURSES: 43 undergraduate 16 graduate

NUMBER OF FACULTY: 25

RESEARCH FACILITIES: See description on page 121.

CONTACT:

John Pequegnat, Chairman
Department of Oceanography
Humboldt State University
Arcata, California
95531 (707) 826-4289

PROGRAM: OCEANOGRAPHY

DEGREE OFFERED: B.S. / MINOR IN OCEANOGRAPHY

DESCRIPTION: Humboldt offers both a Bachelor of Science and a minor degree program in oceanography. The oceanography program is designed to allow the student to accomplish any of the following educational objectives:

1. Preparation as an ocean specialist to work on oceanographic cruises and in other field work undertaken by federal, state, educational, and private agencies

2. Preparation for graduate study in oceanography or in other closely related sciences

3. Provision of a broadly based science background and fundamental knowledge of the oceans for those students who have an academic interest in oceanography but do not intend to pursue it as a career.

In order to meet these objectives, course work and experience required to attain a B.S. degree in oceanography are kept flexible; there are a variety of pathways which the student may follow. All students, regardless of the pathway chosen, acquire a science background of considerable breadth, an understanding of fundamental concepts unique to oceanography, and an appreciation for how concepts from various closely allied science fields are interrelated and applied to the solution of oceanographic problems. To achieve this, students are required to take a block (at least

24 units) of approved upper-division science electives, including courses in biology, geology, physics, mathematics, and chemistry.

Humboldt also offers a degree minor in oceanography. To obtain the minor, a student must complete a general oceanography course and at least 13 units of approved courses.

NUMBER OF MARINE SCIENCE COURSES: 24 undergraduate 2 graduate

NUMBER OF FACULTY: 5

RESEARCH FACILITIES: Students enrolled in the oceanography degree program can gain useful experience in marine studies aboard one of the many research vessels available through Humboldt's marine laboratory in Trinidad, California. (See description on page 121.)

CONTACT:

John P. Pequegnat, Chairman
Department of Oceanography
Humboldt State University
Arcata, California
95521 (707) 826-4289

PROGRAM: ZOOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.A.

DESCRIPTION: Humboldt does not offer an official "zoology with emphasis in marine zoology" degree program. However, students in the zoology program can choose several courses in the marine sciences that are applicable to the major. Such courses include Invertebrate Zoology and Zooplankton Ecology.

NUMBER OF MARINE SCIENCE COURSES: Not applicable--interdisciplinary program

NUMBER OF FACULTY: 4 (zoologists interested in the marine area)

RESEARCH FACILITIES: See description on page 121.

CONTACT:

James P. Smith, Chairman
Department of Biology
Humboldt State University
Arcata, California
95521 (707) 826-3245

FOUR-YEAR PUBLIC

NAVAL POSTGRADUATE SCHOOL

PROGRAM: AIR-OCEAN SCIENCE

DEGREE OFFERED: M.S.

DESCRIPTION: The Naval Postgraduate School offers a Master of Science degree program in meteorology and oceanography. To be admitted directly into the program, students must have a baccalaureate degree in meteorology and/or oceanography or equivalent. Persons lacking a baccalaureate degree in meteorology or oceanography must have taken at least differential and integral calculus, and a year each of college physics and chemistry.

The Master of Science degree program requires the completion of several courses in meteorology and oceanography, totaling approximately 100 quarter hours. Sample courses include Geophysical Fluid Dynamics, Air/Sea Interaction, Random Processes, Dynamic Meteorology, Dynamic Oceanography, Sound in the Ocean, Numerical Modeling, and Basic Hydrography.

General Note:

Naval Postgraduate school's programs for an M.S. degree are approximately two years in length. Only U.S. naval officers, other U.S. military officers, allied country military officers, and civilian employees of the U.S. government are eligible for admission to the Naval Postgraduate School.

NUMBER OF MARINE SCIENCE COURSES: 40 undergraduate 28 graduate

NUMBER OF FACULTY: 32

RESEARCH FACILITIES: See description under Naval Postgraduate School's oceanography program on page 133.

CONTACT:

Christopher N. K. Mooers, Chairman (code 68)
Department of Oceanography
Naval Postgraduate School
Monterey, California
93940 (408) 646-2673

PROGRAM: OCEANOGRAPHY

DEGREE OFFERED: M.S./Ph.D.

DESCRIPTION: The Naval Postgraduate School offers a Master of Science degree program in oceanography. The oceanography program is designed to prepare officers to make the best use of the ocean environment in the course of their duties, and to prepare them to carry out and evaluate research in oceanography and hydrography (mapping, charting, and geodesy), both basic and applied.

Entrance to the M.S. program requires a baccalaureate degree in a field appropriate to the oceanography option chosen. Previous experience at sea is considered advantageous.

Admission to the Ph.D. program requires a master's degree in science or engineering; or a bachelor's degree with a high QPR; or a successful first graduate year on a master's program with clear evidence of research ability.

NUMBER OF MARINE SCIENCE COURSES: 24 undergraduate 16 graduate

NUMBER OF FACULTY: 18

RESEARCH FACILITIES: The Department of Oceanography has two beach-front laboratories, a small biological oceanography laboratory with saltwater aquaria and filtered saltwater circulating system; and a 4,000 square-foot laboratory

with lecture room and student study areas. Equipment includes a wave tank, drying oven, and high-pressure test chamber. Facilities include a small ocean engineering laboratory, chemical oceanography laboratory, and a geological oceanography laboratory.

The Naval Postgraduate School operates the research vessel Acania, a 126-foot vessel used for oceanographic instruction and research. The research vessel and the curriculum are sponsored by the Oceanographer of the Navy.

In addition to the NPS Computer Facility, there are large computational resources at the nearby Fleet Numerical Oceanographic Center and Naval Environmental Prediction Facility. These organizations also have large data bases and satellite image processing facilities. Research is supported through contracts with various government agencies including the Office of Naval Research.

CONTACT:

Christopher N. K. Mooers, Chairman (code 68)
Department of Oceanography
Naval Postgraduate School
Monterey, California
93940 (408) 646-2673

PROGRAM: OCEANOGRAPHY with HYDROGRAPHY OPTION

DEGREE OFFERED: M.S.

DESCRIPTION: (See oceanography program, on preceding pages, for general description, and air-ocean science program, on page 131 for "General Note.")

To complete the option in hydrography, students must take eight courses in addition to the regular requirements for the M.S. degree in oceanography: five courses in hydrography, and one course each in photogrammetry, goedesy, and cartography.

NUMBER OF MARINE SCIENCE COURSES: 24 undergraduate 16 graduate

NUMBER OF FACULTY: 19

RESEARCH FACILITIES: The Naval Postgraduate School's Acania may be used to collect hydrographic/bathymetric data. A 40-foot motor launch is available for shallow water surveys. Cooperative programs with NOAA's Pacific Marine Center in Seattle, Washington, provide additional opportunities for the collection and analysis of hydrographic data. The Fleet Numerical Oceanographic Center (FNOC) and the Naval Environmental Prediction Research Facility (NEPRF), located in the Monterey area, allow analysis of environmental satellite imagery and access to advanced computer processing facilities.

(See description on page 133.)

CONTACT:

LCDR. Dudley Leath, Code 68 LF
Department of Oceanography
Naval Postgraduate School
Monterey, California
93940 (408) 646-3130

CENTER FOR MARINE STUDIES

The primary functions of the Center for Marine Studies at San Diego State University are to coordinate the multidisciplinary Marine Studies Program offered by the departments involved, to aid in the development of instructional, research, and public service aspects of the program, and to provide special services to associated faculty and students. Services provided by the Center include advising students concerning marine studies and employment opportunities; job placement for students; assistance to faculty and students in funding and conducting research and in publishing; the diving safety program; a boat operations program; and operation of the university's marine laboratories. Responsibility for instruction remains within the traditional departments. There are more than 70 faculty members in these departments who are directly involved in the marine studies program. Marine-related courses and research are conducted primarily at the campus, located 12 miles from the coast, and at two marine laboratories operated by the Center for Marine Studies.

RESEACH FACILITIES

Participating science departments have well-equipped laboratory and shop facilities, including standard physical and biological oceanographic equipment, laboratories for the analysis of seawater and sediment characteristics, radioisotope and computer facilities, constant temperature rooms, and experimental aquarium facilities. Marine studies are well represented in library holdings. Boat docking facilities are maintained in Mission Bay, where several 16- to 23-foot craft are available for coastal sampling operations. The use of larger oceanographic vessels and other specialized facilities are arranged in cooperation with the Scripps Institution of Oceanography.

In addition to facilities for marine studies on the main campus, San Diego State University operates two marine laboratories: the San Diego

State University Marine Laboratory, in cooperation with the Hubbs-Sea World Research Institute; and the Encina Laboratory, in cooperation with the San Diego Gas & Electric Company's Encina Power Plant.

The San Diego State University Marine Laboratory, located at Perez Cove on Mission Bay, is operated by the Center for Marine Studies. An 1100 square-foot experimental aquarium building and adjacent outside areas provide space for research involving the use of large tank systems. A 500 square-foot experimental aquarium room with water tables for small-scale experiments is supplied with seawater at ambient temperatures as well as heated and chilled seawater. Additional office-work areas and a classroom are available at the laboratory.

CENTER FOR MARINE STUDIES

Research Facilities (cont.):

Special Research facilities are available through the Hubbs-Sea World Research Institute and Sea World include large tanks and controlled environment systems for research on marine mammals, penguins, and other aquatic birds and fishes.

The Encina Laboratory is used primarily for research on aquaculture and the biological effects of cooling water from electric generating stations. Located at the Encina Power Plant in Carlsbad, 35 miles north of the campus, the laboratory has several experimental aquarium rooms supplied wth regular and thermal effluent seawater. This arrangement allows experiments to be conducted at relatively constant elevated temperatures, at temperatures which vary within controlled limits, as well as as varying ambient ocean and effluent temperatures.

CONTACT:

Richard F. Ford, Director
Center for Marine Studies
San Diego State University
San Diego, California
92182 (714) 265-6523

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: A.B./ B.S./ M.A./ M.S.

DESCRIPTION: San Diego State University does not offer an official "biology with marine biology emphasis" degree program. However, students can emphasize marine studies within the traditional biology department degree program through advanced, marine-related course work and research. The Department of Biology offers three marine-related courses: Biological Oceanography, Fisheries Biology, and Regional Field Studies in Biology. Students who wish to take more marine science courses can choose from a wide assortment of marine-related courses offered by other science disciplines, including courses in oceanography, phycology, marine microbiology, ichthyology, and aquaculture.

NUMBER OF MARINE SCIENCE COURSES: 3 undergraduate (+4 oceanography department courses)
2 graduates

NUMBER OF FACULTY: 17 (specifically marine biology)

RESEARCH FACILITIES: See description on page 137.

CONTACT:

Richard F. Ford, Director
Center for Marine Studies
San Diego State University
San Diego, California
92182 (714) 265-6523

PROGRAM: BOTANY (with MAJOR EMPHASIS)

DEGREE OFFERED: A.B./ B.S.

DESCRIPTION: San Diego State does not offer an official "botany with marine botany emphasis" degree program. Instead, students can emphasize marine studies within the traditional botany department degree program. The Department of Botany offers undergraduate courses in phycology and advance phycology, as well as graduate courses in marine-related fields. Students who wish to take more marine science courses can choose from a wide assortment of marine-related courses offered by other science disciplines, including courses in fisheries biology, biological field studies, aquaculture, and biological oceanography.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate 2 graduate

NUMBER OF FACULTY: 3 (specifically marine botany)

RESEARCH FACILITIES: See description on page 137.

CONTACT:

David L. Rayle, Chairman
Department of Botany
San Diego State University
San Diego, California
92182 (714) 265-5354

PROGRAM: CHEMISTRY (with MARINE EMPHASIS)

DEGREE OFFERED: A.B./ B.S./ M.A./ M.S.

DESCRIPTION: San Diego State does not offer an official "chemistry with marine chemistry emphasis" degree program. Instead, students can emphasize marine studies within the traditional chemistry department degree program. The Department of Chemistry offers undergraduate courses in chemical oceanography and graduate courses in marine-related fields. Students who wish to take more marine science courses can choose from a wide assortment of marine-related courses offered by other science disciplines, including courses in oceanography laboratory, biological oceanography, geochemistry, physical oceanography, and marine microbiology.

NUMBER OF MARINE SCIENCE COURSES: 1 undergraduate (+4 oceanography department courses) 2 graduate

NUMBER OF FACULTY: 3 (specifically marine chemistry)

RESEARCH FACILITIES: See description on page 137.

CONTACT:

James H. Mathewson
Department of Chemistry
San Diego State University
San Diego, California
92182 (714) 265-5157

PROGRAM: ECOLOGY

DEGREE OFFERED: Ph.D. (Joint with UC Davis)

DESCRIPTION: A new doctoral program leading to a Ph.D. in ecology is being offered jointly by the Ecology Program Area at SDSU and the Graduate Group in Ecology at UC Davis. Students admitted to the program will spend at least one year in full-time residence at each campus and may elect to carry out their thesis research at either campus. When the major professor (dissertation adviser) is at SDSU, the student will do the majority of his work at SDSU and students who elect to work under a UCD faculty member will spend most of their time at UCD. Regardless of which campus is chosen for longer residence, the Ph.D. is awarded jointly by the two institutions.

The principal objective of the joint doctoral program is to provide excellent training in biological ecology for a modest number of doctoral students. This jointly offered program offers several distinct opportunities. It makes available to students a broader range of faculty members with whom to interact, a greater diversity of courses, and a greater variety of possible research experiences. It provides easier access to a wide range of field areas for ecological research, since representatives of nearly all the major biomes of California are close to at least one of the campuses. Students are eligible for financial assistance and have the opportunity to obtain teaching experience while in the program.

NUMBER OF MARINE SCIENCE COURSES: Not applicable -- individual program.

NUMBER OF FACULTY: 14

RESEARCH FACILITIES: See description on page 137.

CONTACT:

Dr. William Hazen
Department of Biology
San Diego State University
San Diego, California
92128 (714) 265-6701

PROGRAM: ECONOMICS (with MARINE EMPHASIS)

DEGREE OFFERED: A.B./ M.A.

DESCRIPTION: San Diego State does not offer an official "economics with marine economics emphasis" degree program. Instead, students can emphasize marine studies within the traditional economics department degree program. The Department of Economics offers two undergraduate courses: Economics and Ecology, and Economics of the Ocean. Students who wish to take more marine science courses can choose from marine-related courses offered by other disciplines, such as courses in biology, oceanography, politics, engineering, chemistry, geography, geology, botany, business, microbiology, or botany.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate 0 graduate

NUMBER OF FACULTY: 3 (specifically marine economics)

RESEARCH FACILITIES: See description on page 137.

CONTACT:

Virginia F. Flagg
Department of Economics
San Diego State University
San Diego, California
92182 (714) 286-5478

PROGRAM: ENGINEERING (with MARINE EMPHASIS)

DEGREE OFFERED: B.S./ M.S.

DESCRIPTION: San Diego State does not offer an official "engineering with marine engineering emphasis" degree program. Instead, students can emphasize marine studies within the traditional engineering interdepartmental degree program. The School of Engineering offers several undergraduate engineering courses in marine-related fields, including courses in fluid mechanics, water resources engineering, soil mechanics, hydrodynamics, and water and wastewater engineering, in addition to graduate courses in water quality processes, foundation engineering, and water quality engineering.

NUMBER OF MARINE SCIENCE COURSES: 9 (marine-related, +4 oceanography department courses) undergraduate 6 (marine-related) graduate

NUMBER OF FACULTY: 7 (specifically marine engineering)

RESEARCH FACILITIES: See description on page 137.

CONTACT:

Iraj Noorany
Department of Civil Engineering
San Diego State University
San Diego, California
92182 (714) 265-6380

PROGRAM: GEOGRAPHY (with MARINE EMPHASIS)

DEGREE OFFERED: A.B./ M.A.

DESCRIPTION: San Diego State does not offer an official "geography with marine geography emphasis" degree program. Instead, students can emphasize marine studies within the traditional geography department degree program. The Department of Geography offers two graduate courses that may concern marine-related fields: Systematic Geography, and Problems of Environment and Resource Conservation; and two undergraduate courses: Coastal and Submarine Physiography, and Geography of Marine Resources.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate 2 graduate

NUMBER OF FACULTY: 5 (specifically marine geography)

RESEARCH FACILITIES: See descriptions on page 137.

CONTACT:

E. A. Keen
Department of Geography
San Diego State University
San Diego, California
92182 (714) 265-6639

PROGRAM: GEOLOGICAL SCIENCES (with MARINE EMPHASIS)

DEGREE OFFERED: B.S./ M.S.

DESCRIPTION: San Diego State does not offer an official "geological sciences with marine emphasis" degree program. Instead, students can emphasize marine studies within the traditional geological sciences department degree program. The Department of Geological Sciences offers several marine-related undergraduate courses, including Geochemistry, Marine Geology, Descriptive Physical Oceanography, and Coastal and Estuarine Physical Oceanography. The department offers several graduate courses in marine-related fields, including courses in petrology of carbonates, biostratigraphy, peleoecology, and sedimentary geochemistry.

NUMBER OF MARINE SCIENCE COURSES: 4 undergraduate (+4 oceanography department courses) 5 (marine-related) graduate

NUMBER OF FACULTY: 9 (specifically marine geology)

RESEARCH FACILITIES: See descriptions on page 137.

CONTACT:

Patrick Abbott, Chairman
Department of Geological Sciences
San Diego State University
San Diego, California
92182 (714) 265-5586

PROGRAM: GEOLOGY with B.S. DEGREE IN APPLIED ARTS AND SCIENCES, MARINE GEOLOGY OPTION

DEGREE OFFERED: B.S.

DESCRIPTION: San Diego State offers a Bachelor of Science degree in applied arts and sciences with major in geology and option in marine geology. Students in this program take the basic requirements for the geology major, plus the requirements of the marine geology option. The option requires several additional courses from the geology, mathematics, physics, and chemistry departments.

NUMBER OF MARINE SCIENCE COURSES: 6 undergraduate 4 graduate

NUMBER OF FACULTY: 18

RESEARCH FACILITIES: See descriptions on page 137.

CONTACT:

Patrick Abbott, Chairman
Department of Geological Sciences
San Diego State University
San Diego, California
92182 (714) 265-5586

PROGRAM: MICROBIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: A.B./ B.S./ M.S.

DESCRIPTION: San Diego State does not offer an official "microbiology with marine emphasis" degree program. Instead, students can emphasize marine studies within the traditional microbiology department degree program. The Department of Microbiology offers two upper-division marine-related courses: Marine Microbiology and Marine Microbiology Laboratory; and a graduate seminar in aquatic microbiology.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate 1 graduate

NUMBER OF FACULTY: 2 (specifically marine microbiology)

RESEARCH FACILITIES: The Department of Microbiology has the facilities and equipment to support research in many of the areas of marine microbiology. See descriptions on page 137.

CONTACT:

Barbara B. Hemmingsen
Department of Microbiology
San Diego State University
San Diego, California
92182 (714) 265-6275

PROGRAM: OCEANOGRAPHY MINOR

DEGREE OFFERED: (part of baccalaureate)

DESCRIPTION: San Diego State offers a program for a minor in oceanography. The minor is offered by the geology department, and interdisciplinary instructional and research activities are coordinated by the Center for Marine Studies. Students opting for the oceanography minor program can choose from such courses as Biological Oceanography, Chemical Oceanography, Marine Geology, Descriptive Physical Oceanography, Theoretical Physical Oceanography, Coastal and Estuarine Physical Oceanography, Marine Microbiology, Marine Invertebrate Zoology, The Oceans, Oceanography Laboratory, and Practical Oceanography.

The oceanography minor is intended for students with extensive background in the sciences. The oceanography minor is not open to geology majors. Geology students interested in the marine sciences should major in geology with the marine geology option.

NUMBER OF MARINE SCIENCE COURSES: 10 undergraduate 4 graduate

NUMBER OF FACULTY: 18

RESEARCH FACILITIES: See descriptions on page 137.

CONTACT:

Patrick Abbott, Chairman
Department of Geological Sciences
San Diego State University
San Diego, California
92182 (714) 265-5586

PROGRAM: POLITICAL SCIENCE (with MARINE EMPHASIS)

DEGREE OFFERED: A.B./ M.A.

DESCRIPTION: San Diego State does not offer an official "political science with marine emphasis" degree program. Instead, students can emphasize marine studies within the traditional political science department degree program. Students who wish to take marine science-related courses can choose from those offered in other disciplines, including courses in biology, oceanography, engineering, chemistry, geography, economics, geology, botany, business, microbiology, or botany.

NUMBER OF MARINE SCIENCE COURSES: Not Applicable--Interdepartmental program

NUMBER OF FACULTY: 3 (specifically, marine politics)

RESEARCH FACILITIES: See descriptions on page 137.

CONTACT:

C. Richard Hofstetter
Department of Political Science
San Diego State University
San Diego, California
92182 (714) 265-6277

PROGRAM: ZOOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: A.B./ B.S.

DESCRIPTION: San Diego State University does not offer an official "zoology with marine zoology emphasis" degree program. Instead, students can emphasize marine studies within the traditional zoology department degree program. Students can choose from several marine-related undergraduate courses, including Marine Invertebrate Zoology, Ichthyology, and Aquaculture. Graduate courses included courses in marine zoology, biology of cold-blooded vertebrates, biology of warm-blooded vertebrates, marine invertebrate zoology, and advanced lower vertebrate zoology.

NUMBER OF MARINE SCIENCE COURSES: 3 undergraduate 4 graduate

NUMBER OF FACULTY: 10 (specifically marine zoology)

RESEARCH FACILITIES: See description on page 137.

CONTACT:

Richard F. Ford, Director
Center for Marine Studies
San Diego State University
San Diego, California
92182 (714) 265-6523

FOUR-YEAR PUBLIC

SAN FRANCISCO STATE UNIVERSITY

PROGRAM: BIOLOGY with MARINE CONCENTRATION

DEGREE OFFERED: B.A./ M.A.

DESCRIPTION: San Francisco State offers both a Bachelor of Arts and a Master of Arts degree program in biology with concentration in marine biology. The liberal arts undergraduate major provides students with a fundamental understanding of general biology and concentration in their chosen fields of emphasis. It also provides a foundation for graduate study in any of the liberal arts graduate concentrations of the biology department.

Students may elect a general emphasis in marine invertebrate zoology, marine vertebrate zoology, marine botany, or marine microbiology. Graduate work also may be general or may follow similar specific strengths such as ecology, systematics, functional morphology, physiology and ethology.

The marine curriculum and facilities of San Francisco State are strongly supported by the Moss Landing Marine Laboratories which San Francisco State operates jointly with five other state colleges and universities.

Students interested in this marine biology program have quite a selection of courses from which to choose. Sample courses include those in marine invertebrate physiology, algology, marine phycology, natural history of marine invertebrates, biology of

fishes, ichthyology laboratory, biological oceanography, general oceanography, marine ecology, and an introduction to marine plankton.

NUMBER OF MARINE SCIENCE COURSES: 15 undergraduate (22 at MLML) 7 graduate (23 at MLML)

NUMBER OF FACULTY: 12

RESEARCH FACILITIES: The Moss Landing Marine Laboratories, approximately one hundred miles south of San Francisco, are operated year-round by a consortium of six California state universities and colleges. San Francisco State is one of those cooperating universities, and students can attend classes and do research at the Moss Landing facility.

The laboratories offer full-time course work in oceanography - including marine biology, marine geology, and other marine sciences - for majors in either the biological or physical sciences whose objectives include further graduate study, teaching the sciences, or research in the marine sciences. See also description of MLML under San Jose State University, on page 161.

RESEARCH FACILITIES:
(cont.) San Francisco State's School of Science is developing a research facility on the shore of San Francisco Bay at Tiburon, adjacent to a National Marine Fisheries Service laboratory. With five full-time Ph.D.'s doing marine research there now, the Tiburon Center for Environmental Studies is designed to enhance and support marine research in the bay. Rapid growth and development of the Center's 40-acre research facility is anticipated.

CONTACT:
(undergraduate)

Robert Berrend
Department of Biology
San Francisco State University
1600 Holloway Avenue
San Francisco, California
94132 (415) 469-1298

or
(undergraduate)

Margaret Bradbury
Department of Biology
San Francisco State University
1600 Holloway Avenue
San Francisco, California
94132 (415) 469-1298

or

(graduate)

Thomas Niesen
Department of Biology
San Francisco State University
1600 Holloway Avenue
San Francisco, California
94132 (415) 469-2198

FOUR-YEAR PUBLIC

SAN JOSE STATE UNIVERSITY

PROGRAM: BIOLOGICAL SCIENCE with MARINE BIOLOGY CONCENTRATION

DEGREE OFFERED: B.A./ M.A.

DESCRIPTION: San Jose State offers both a Bachelor of Arts and a Master of Arts degree program in biological sciences with concentration in marine biology. The curriculum for the program satisfies the requirements for a major in biological science (and, at the student's option, a minor in chemistry), and will lead to graduate work in the field of marine biology. The concentration emphasizes a program which involves the student in courses available at Moss Landing Marine Laboratories.

Students in this program can choose courses from several disciplines, including physics, geology, mathematics, physical education, chemistry, zoology, biology, botany, microbiology, and marine science.

NUMBER OF MARINE SCIENCE COURSES:

2 undergraduate (25 at MLML)	0 graduate (21 at MLML)

NUMBER OF FACULTY: 44

RESEARCH FACILITIES: San Jose State is one of the six California state colleges and universities operating the Moss Landing Marine Laboratories. This facility offers full-time course work in marine biology, oceanography, and other marine sciences. The curriculum offered at Moss Landing is designed to support majors in biological and physical sciences through course offerings which may

be incorporated into those of the biology, chemistry, and geology degree requirements. See description of MLML on next page.

CONTACT:

Joseph H. Young, Chairman
Department of Biological Sciences
Duncan Hall 254
San Jose State University
San Jose, California
95192 (408) 277-2355

or

John Martin, Director
Moss Landing Marine Laboratories
P.O. Box 223
Moss Landing, California
95039 (408) 633-3304

RESEARCH FACILITIES:

Moss Landing Marine Laboratories is centrally located on Monterey Bay in Moss Landing, approximately halfway between Santa Cruz and the Monterey Peninsula. The laboratories are owned and operated by a consortium of six of the California state universities and colleges: CSU, Fresno; CSU, Hayward; CSU, Sacramento; San Francisco State University; and CSC, Stanislaus. San Jose State University serves as the administering institution. The laboratories' function is similar to that of a department for each of the home campuses, with students from all six of them attending classes at Moss Landing.

The laboratories occupy a building of approximately 14,000 square feet, equipped for instruction and research in the marine sciences. Specialized facilities include a photographic dark room, a filtered-air clean laboratory for trace element analyses, a benthic sorting shed, and a museum with collections of local fish, invertebrates, birds, mammals, and algae. Permanent equipment includes various microscopes, balances, and spectrophotometers, as well as a C-H-N analyzer, a freeze-dry machine, several programmable desk-top computers, a Coulter counter, closed circuit TV, Warberg respirometer, an x-ray system, a liquid scintillation counter, and numerous other items. A well-equipped shop permits construction of special equipment. A filtered seawater system supplies seawater to several classrooms, laboratories, and holding tanks.

The laboratories operate the research vessel Cayuse, a 79-foot converted ocean tug on lease from Oregon State University. The Cayuse is well-equipped for instructional uses and coastal research with a trawling winch, a hydrowinch, and a boom; a wet lab for hydrographic sampling, water chemistry, and preliminary sorting of specimens; a walk-in freezer; and a dry lab for oceanographic profiling instrumentation and other work.

the lab includes a flow-thru systems for horizontal profiling of chlorophyll, turbidity, temperature, and salinity. A beam transmissometer and sophisticated CTD system are available for vertical profiling. There is a large working area on the fantail for trawling and geological work.

Moss Landing Marine Laboratories has 10 faculty to teach the 22 undergraduate and 23 graduate courses offered every year. Faculty and students from MLML also utilize University National Oceanographic Laboratory System (UNOLS) vessels when they have open research requirements.

CONTACT:

John Martin, Director
Moss Landing Marine Laboratories
P.O. Box 223
Moss Landing, California
95039 (408) 633-3304

PROGRAM: CHEMISTRY with OCEANOGRAPHIC CONCENTRATION

DEGREE OFFERED: M.S.

DESCRIPTION: San Jose State offers a Master of Science degree program in chemistry with research opportunities in chemical oceanography. Students can design the chemical research in oceanography by consulting with an advisor. Chemistry students interested in marine studies can take courses offered at the Moss Landing Marine Laboratories.

NUMBER OF MARINE SCIENCE COURSES: Not applicable--individual major

NUMBER OF FACULTY: Not applicable--individual major

RESEARCH FACILITIES: See description of the Moss Landing Laboratories on previous page 161.

CONTACT:

Arthur Stump
Department of Chemistry
Duncan Hall
San Jose State University
San Jose, California
95192 (408) 277-2358 or 277-2366

PROGRAM: GEOLOGY with OCEANOGRAPHY CONCENTRATION

DEGREE OFFERED: B.A./ B.S.

DESCRIPTION: San Jose State offers a Bachelor of Arts and a Bachelor of Science degree program in geology with concentration in oceanography. In addition to the general education requirements, students interested in obtaining the special marine emphasis geology degree take courses from several disciplines, including courses in geological sciences, marine sciences, mathematics, chemistry, physics and civil engineering. Students interested in studying marine geology can take courses by the Moss Landing Marine Laboratories.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate (10 at MLML) 0 graduate (8 at MLML)

NUMBER OF FACULTY: 9

RESEARCH FACILITIES: See page 161.

CONTACT:

Calvin H. Stevens, Chairman
Department of Geology
San Jose State University
San Jose, California
95192 (408) 277-2385

FOUR-YEAR PUBLIC

SONOMA STATE UNIVERSITY

PROGRAM: BIOLOGY (with AQUATIC EMPHASIS)

DEGREE OFFERED: B.A.

DESCRIPTION: Sonoma State does not offer an official Bachelor of Arts degree program in "biology with an emphasis in aquatic biology." However, they offer an aquatic biology and water quality advisory plan for students interested in the marine sciences. Students following the advisory plan and completing the B.A. degree program in biology will be qualified to enter a graduate program in aquatic biology or to apply for employment in that field.

Students in the advisory program take courses from several disciplines, including biology, chemistry, mathematics, physics, and geology.

NUMBER OF MARINE SCIENCE COURSES: 4 undergraduate 0 graduate

NUMBER OF FACULTY: 17

RESEARCH FACILITIES: Sonoma State has a boat, as well as access to an osborne preserve and numerous lakes, streams and estuaries. They have most of the equipment necessary for research in aquatic biology.

CONTACT:

Joseph Powell
Professor of Marine Biology
Sonoma State University
1801 E. Cotati Avenue
Rohnert Park, California
94928 (707) 664-2189

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE PROGRAM: B.A.

DESCRIPTION: Sonoma State does not offer an official "biology with marine emphasis" degree program. However, they offer a marine biology advisory plan for students interested in marine biology. Students who complete the B.A. degree in biology with the marine biology advisory plan will be qualified to enter a graduate program in the marine sciences or to apply for employment in this field.

Students following the marine advisory plan take courses in several disciplines, including biology, chemistry, geology, physics, and mathematics. Students can take specific marine-oriented courses, such as Ichthyology, Marine Ecology, and Functional Morphology of Marine Invertebrates.

NUMBER OF MARINE SCIENCE COURSES: 8 undergraduate 2 graduate

NUMBER OF FACULTY: 17

RESEARCH FACILITIES: See description on page 165.

CONTACT:

Joseph Powell
Professor of Marine Biology
Sonoma State University
1801 E. Cotati Avenue
Rohnert Park, California
94928 (707) 664-2189

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, BERKELEY

PROGRAM: BIOLOGY with MARINE SPECIALIZATION

DEGREE OFFERED: B.A.

DESCRIPTION: UC Berkeley offers a Bachelor of Arts degree program in biology with specialization in marine biology. The program is a field major, and it serves the needs of undergraduate students who want a broader training in the biological sciences than is possible in a departmental major.

Students enrolled in the program take courses from several fields, including biology, zoology, paleontology, botany, genetics, biological oceanography, chemistry, physics, and statistics. They must complete a one-quarter course or summer course at a marine laboratory. This requirement is usually met by taking summer courses in biology of marine invertebrates and/or in marine algology, offered at the Bodega Marine Laboratory by the Departments of Zoology and Botany, respectively, or by a full-time (15 unit) intercampus spring quarter course, Special Problems in Marine Biology, taught at the Bodega Marine Lab. The course is sponsored by several departments and draws staff and students from the Davis, San Diego, Santa Cruz, and Berkeley campuses.

NUMBER OF MARINE SCIENCE COURSES: 12 undergraduate 3 graduate (interdepartmental course offerings)

NUMBER OF FACULTY: 6 (specifically marine)

RESEARCH FACILITIES: Research in marine biology is conducted at the Berkeley campus and mainly at the Bodega Marine Laboratory. A minor component of the program is in San Diego, where research is conducted through the university's marine facilities at the Scripps Institution of Oceanography.

CONTACT:

John West
Department of Botany
University of California
Berkeley, California
94720 (415) 642-1487 or 642-6712

or

Ralph Smith
Department of Zoology
University of California
Berkeley, California
94720 (415) 642-3151 or 642-3281

PROGRAM: BOTANY (with MARINE SPECIALIZATION)

DEGREE OFFERED: M.A./ Ph.D.

DESCRIPTION: UC Berkeley does not offer an official graduate degree program in "botany with marine specialization." However, several members of the Department of Botany have special research interests in marine botany. Under their supervision, graduate students who wish to do so may specialize in marine botany within the traditional botany graduate program.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate 1 graduate

NUMBER OF FACULTY: 1 (specifically marine)

RESEARCH FACILITIES: See description on page 170.

CONTACT:

John West
Department of Botany
University of California
Berkeley, California
94720 (415) 642-1487 or 642-6712

PROGRAM: GEOPHYSICS

DEGREES OFFERED: B.S. / M.S. / Ph.D.

DESCRIPTION: The major in geophysics is designed for students with facility in mathematics and an interest in geology; it provides a general background in the physical sciences, with emphasis on the physics of the earth. The Master's degree is given by examination. Candidates must also complete a minimum of 36 units of upper division and graduate courses, of which at least 18 must be strictly graduate work. The degree usually requires between one and two years of full-time study. The examination must be taken before the end of the second academic year of studies.

Candidates for the Ph.D. degree must pass the examination for the Master's degree, satisfy the foreign language requirement, and pass an oral qualifying examination covering a broad field of knowledge in the physical sciences. There is no formal course requirement for the degree, except that candidates are encouraged to take at least 8 units of graduate work in mathematics, and a comparable number of units related to their field of interest (e.g., advanced dynamics, electromagnetism, etc.) in other departments. The qualifying examination is taken early in the third year of graduate work. By that time the language requirement has been satisfied and a research adviser selected. The preparation of a thesis requires at least a full academic year.

NUMBER OF MARINE SCIENCE COURSES: 0

NUMBER OF FACULTY: 6

RESEARCH FACILITIES: The University operates 16 seismographic stations in northern California to study the seismicity here and in adjacent parts of Nevada and Oregon and to conduct other research in seismology. Research includes the study of earthquake wave propagation, the nature of the waves, their relation to earth structure, the nature of earthquake sources, eigenvibrations of the earth, and the theory of the seismograph. Offices are in the Earth Sciences Building; seismographs and laboratories are in Haviland Hall and in an underground vault in Strawberry Canyon.

CONTACT:

Dr. Ian Carmichael
Geology and Geophysics
301 Earth Sciences Building
University of California
Berkeley, California
94720 (415) 642-2577

PROGRAM: NAVAL ARCHITECTURE

DEGREES OFFERED: M.S. / Ph.D

DESCRIPTION: The Department of Naval Architecture offers courses in the fundamentals of marine-vehicle design and the theories of ship structures and ship hydrodynamics.

There is no undergraduate major, but undergraduate courses are offered, and students interested in naval architecture may elect courses in this department as an option within the mechanical engineering major.

Graduate study is offered in the areas of ship structures and ship hydrodynamics, leading to both the master's and doctor's degrees. With sufficient undergraduate preparation, a student may earn a master's degree in three quarters of study. Further details on graduate programs (including the program in ocean engineering) are available from the department upon request.

NUMBER OF MARINE SCIENCE COURSES: 6

NUMBER OF FACULTY: 4

RESEARCH FACILITIES: University of California, Berkeley has some of the most outstanding research facilities of any university in the world. Of particular application to this department are the Richmond Field Station and the Ship Model Towing Tank as well as outstanding computer facilities.

CONTACT:

John V. Wehausen
202 Naval Architecture Building
University of California
Berkeley, California
94720 (415) 642-5464

PROGRAM: OCEAN ENGINEERING

DEGREE OFFERED: M.S./ M.E./ Doctor of Engineering/ Doctor of Philosophy in Engineering

DESCRIPTION: UC Berkeley offers several graduate-level degree programs in ocean engineering. The ocean engineering program is interdisciplinary: it incorporates a wide range of engineering disciplines, including civil engineering, materials science, mineral engineering, mechanical engineering, and naval architecture.

Graduate students in the ocean engineering program study a multitude of marine-related engineering programs, such as air-sea interactions, coastal engineering, corrosion in sea water, desalination, marine and offshore construction, harbor design, marine geophysics, waste disposal, engineering properties of marine sediments, ocean mining and prospecting, oceanographic data analyses, marine sediment transport, ocean energy, oceanographic instrumentation, offshore platforms and pipelines, marine and estuarine pollution control, oceanographic vehicles, and properties of engineering materials in sea water.

Research is conducted chiefly in the various laboratories on the Berkeley campus and at the Richmond Field Station, the Bodega Marine Laboratory, and the Scripps Institution of Oceanography.

NUMBER OF MARINE SCIENCE COURSES: Not applicable--interdisciplinary program

NUMBER OF FACULTY: Not applicable--interdisciplinary program

RESEARCH FACILITIES: Research in the ocean engineering field is conducted at the Richmond Field Station and the Bodega Marine Laboratory. Oceanographic research vessels and ship time are available locally through working arrangements with the California Maritime Academy and other sources, and in San Diego for world-wide operations through the university's marine facilities at the Scripps Institution of Oceanography.

CONTACT:

William Houston
Professor of Civil Engineering
201 Naval Architecture Building
University of California
Berkeley, California
94720 (415) 642-5464

PROGRAM: PALEONTOLOGY (with MARINE SPECIALIZATION)

DEGREE OFFERED: B.A./ M.A./ Ph.D.

DESCRIPTION: UC Berkeley does not offer an official degree program in "paleontology with marine specialization." However, several members of the Department of Paleontology have particular research interests in marine paleontology. Under their supervision, graduate students can design a major program reflecting a marine paleontology specialization.

NUMBER OF MARINE SCIENCE COURSES: 2 undergraduate 1 graduate

NUMBER OF FACULTY: 3 (specifically marine)

RESEARCH FACILITIES: See page 170.

CONTACT:

Carole S. Hickman
Assistant Professor of Paleontology
193 Earth Sciences Building
University of California
Berkeley, California
94720 (415) 642-3429

or

William B.N. Berry, Chairman
Department of Paleontology
281 Earth Sciences Building
University of California
Berkeley, California
94720 (415) 642-3925

PROGRAM: ZOOLOGY (with MARINE SPECIALIZATION)

DEGREE OFFERED: B.A./ M.A./ Ph.D.

DESCRIPTION: UC Berkeley does not offer a degree program in "zoology with marine specialization." However, several members of the Department of Zoology have special research interests in marine zoology. Under their supervision, students may design a zoology program with a marine emphasis.

NUMBER OF MARINE SCIENCE COURSES: 6 undergraduate 4 graduate

NUMBER OF FACULTY: 7 (specifically marine)

RESEARCH FACILITIES: Work in marine ecology, seabird biology, physiological ecology and comparative physiology is carried out locally in San Francisco Bay and at the Bodega Marine Laboratory. Occasionally, arrangements can be made to use facilities at Stanford's Hopkins Marine Station and the Center for Coastal Marine Studies at the Santa Cruz campus of the University of California.

CONTACT:

Ralph Smith
Department of Zoology
University of California
Berkeley, California
94720 (415) 642-3151 or 642-3281

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA

DAVIS

PROGRAM: AGRICULTURAL ECONOMICS

DEGREE OFFERED: B.S./M.S./Ph.D.

DESCRIPTION: Agricultural and Managerial Economics focuses on the student's understanding of the total economic and social environment through study of the agricultural, biological, physical, and social sciences. The major offers an option of two areas of specialization: (a) Agricultural Economics and (b) Managerial Economics.

The Agricultural Economics option is preprofessional, essentially preparation for continued study at the graduate level. The emphasis is on the theoretical aspects which lie behind decisions concerning production, marketing, use of resources, prices, and policy. Supplemental courses are offered in statistics, effects of governmental policy, rural appraisal, and related topics.

The Managerial Economics options, while considering the theoretical, deals more with the practical managerial problems. Emphasis is on the decision making function of management, use of scientific management controls and organization, personnel policies, and procurement and marketing methods.

Both options prepare graduates for professional management positions in financial and research institutions not necessarily limited to agriculture.

The Department offers courses in natural resource

economics. In graduate research it is possible to emphasize marine aspects of economics such as fisheries, seafood and aquaculture within agricultural economics.

NUMBER OF MARINE SCIENCE COURSES: Not applicable -- individual program.

NUMBER OF FACULTY: 4 (in marine research)

RESEARCH FACILITIES: See description of Bodega Bay Marine Laboratory on page 184.

CONTACT:

Dr. B.C. French
118 Voorhies Hall
University of California
Davis, California
95616 (916) 752-1517

PROGRAM: ANIMAL SCIENCE (with AQUACULTURE SPECIALIZATION)

DEGREE OFFERED: B.S./ M.S./ Ph.D.

DESCRIPTION: Animal science is the study of domestic animal resource use through the integration of natural and social sciences such as genetics, biochemistry, physiology, nutrition, and economics. Emphasis may be placed on scientific, production, and management aspects of aquaculture.

The aquaculture program at the University of California, Davis is housed in the College of Agriculture and Environmental Sciences and operates across departments within this college. Physically, the program is divided between its marine work at the Bodega Marine Laboratory and its freshwater work on the Davis campus.

At UCD, to a large extent, graduate study is directed by faculty divided into "graduate groups" according to their research interests, not departments or college affiliations. Graduate students interested in aquaculture have chosen a variety of disciplines to pursue their degrees, such as ecology, nutrition, genetics, physiology, zoology, water science, animal science, international agricultural development, and engineering. These students complete the requirements for their particular graduate groups, but their research projects concern problems in aquaculture.

NUMBER OF MARINE SCIENCE COURSES: 3 undergraduate (numerous aquaculture courses offered in other departments with participating faculty) 0 graduate

NUMBER OF FACULTY: 20 (8 specifically in the Department of Animal Science)

RESEARCH FACILITIES: At Bodega Marine Laboratory, scientists and students work in a 20,000-square-foot facility designed and built specifically for aquacultural research. This complex contains large animal-holding facilities and laboratories designed for studies in genetics, pathology, nutrition, and physiology. On the Davis campus, in addition to individual faculty laboratories, there is a trout hatchery, a sturgeon hatchery, and aquatic facilities designed for freshwater species such as crayfish, striped bass, and mosquitofish.

CONTACT:

Wallis H. Clark, Jr., Director
Aquaculture Program
254 Animal Science Building
University of California
Davis, California
95616 (916) 752-7600

PROGRAM: ECOLOGY

DEGREE OFFERED: M.S./Ph.D.

DESCRIPTION: The Graduate Group in Ecology includes more than 130 faculty from 42 departments in six schools and colleges. The broad options available for student specialization are biological, human, and physical-chemical ecology. One of the major objectives of the program is to encourage cross-disciplinary training with principles of ecology as central to the application of other disciplinary skills.

Appropriate preparation is undergraduate work in any of the biological, social or behavioral, and physical sciences, mathematics or engineering. But note that all applicants to the (1) biological and (3) physical-chemical areas will normally be expected to have completed a one-year sequence in basic biology, in elementary chemistry, in elementary physics; a course in statistics, one in calculus, and one in computer programming or other suitable mathematical training; and a course in ecology. Applicants to the (2) human ecology area will normally be expected to have completed a one-year sequence in basic biology, a course in evolution or genetics; two courses in chemistry; one course in physics; one course in calculus, one in statistics; and a course in ecology.

NUMBER OF MARINE SCIENCES COURSES: Not applicable -- individual major.

NUMBER OF FACULTY: (interdepartmental program)

RESEARCH FACILITIES: See description of Bodege Marine Laboratory on page 184.

CONTACT:

Dr. R.M. Love
Wickson Hall
University of California
Davis, California
95616 (916)752-6751

PROGRAM: BIOLOGICAL SCIENCES (with MARINE EMPHASIS)

DEGREE OFFERED: B.S./ M.S./ Ph.D.

DESCRIPTION: UC Davis does not offer an official degree program in "biological sciences with marine specialization." However, students in the biology baccalaureate degree program may enroll in a three-month, full-time field study at the Bodega Marine Laboratory.

NUMBER OF MARINE SCIENCE COURSES: 5 undergraduate 1 graduate

NUMBER OF FACULTY: 1 (specifically marine biology; the rest are dispersed throughout the departments)

RESEARCH FACILITIES: Reseach is conducted at the Bodega Marine Laboratory, a UC facility north of San Francisco. See description of Bodega Marine Laboratory on page 184.

CONTACT:

David W. Phillips
Assistant Professor of Zoology
4328 Storer Hall
University of California
Davis, California
95616 (916) 752-1114 or 752-2937

PROGRAM: INDIVIDUAL MAJOR: ENVIRONMENTAL STUDIES with SPECIALIZATION in ECOLOGICAL ANALYSIS, SUBSPECIALIZATION: AQUATIC ECOLOGY

DEGREE OFFERED: B.S.

DESCRIPTION: The Division of Environmental Studies at UC Davis does not offer a degree program. However, it recommends that "highly motivated undergraduates who find existing majors unsuited to their educational objectives [should] contact the division...regarding individual majors."

The department offers elective programs for students from a variety of majors. One such elective program, entitled "Ecological Analysis with Subspecialization in Aquatic Ecology," is designed to supplement the natural scientists' curriculum.

The ecological analysis emphasis includes courses in general and population ecology, community dynamics analysis, ecological system evolution, field and laboratory methods in ecology, limnology laboratory, and experimental animal ecology.

The subspecialization in aquatic ecology includes courses in limnology, physical and chemical oceanography, geology of the oceans, biological oceanography, and ecology of polluted waters.

The Division of Environmental Studies is an intercollege teaching unit, and its programs, such as the one

listed here, are examples of what students may pursue at UC Davis.

NUMBER OF MARINE SCIENCE COURSES: 6 undergraduate 0 graduate

NUMBER OF FACULTY: Not applicable--interdepartmental program

RESEARCH FACILITIES: Laboratories for research in fish physiology and ecology are located in Briggs Hall and the Institute of Ecology.

CONTACT:

Francisco J. Ayala, Associate Dean
Division of Environmental Studies
2132 Wickson Hall
University of California
Davis, California
95616 (916) 752-3026

PROGRAM: INDIVIDUAL MAJOR: MARINE BIOLOGY

DEGREE OFFERED: B.S.

DESCRIPTION: UC Davis does not offer an official "marine biology" degree program. However, interested students can design an individual major in marine biology by submitting an appropriate program proposal to the Individual Majors Committees of the College of Letters and Science or the College of Agricultural and Environmental Sciences. Sample programs that have recently been approved include courses from biochemistry, botany, biological sciences, geology, genetics, and zoology.

NUMBER OF MARINE SCIENCE COURSES: Not applicable--individual program

NUMBER OF FACULTY: Not applicable--individual program

RESEARCH FACILITIES: Research is conducted at the Bodega Marine Laboratory, a UC facility north of San Francisco. See description of Bodega Marine Laboratory on page 184.

CONTACT:

David W. Phillips
Assistant Professor of Zoology
4348 Storer Hall
University of California
Davis, California
95616 (916) 752-1114 or 752-2937

PROGRAM: WILDLIFE AND FISHERIES BIOLOGY with FISHERIES SPECIALIZATION

DEGREE OFFERED: B.S.

DESCRIPTION: UC Davis offers a Bachelor of Science degree program in wildlife and fisheries biology with a specialization in fisheries biology. Although the program is not clearly defined as a marine science-oriented program, students may take courses in marine invertebrates and oceanography to complete the major, in place of freshwater-oriented courses. The three required fisheries courses place equal emphasis on marine and freshwater fishes.

The summer field course in fish biology is sometimes offered at a coastal location, allowing study of marine and estuarie fishes.

The major deals with the interface between the needs of man and wildlife in terms of ecological stability, recreation, and food supply. Emphasis is placed on biological and physical sciences, with special emphasis in fisheries. The program provides training in biology appropriate to careers as fisheries biologists, fish technicians, or, after additional academic preparation, for careers in teaching, research, and administration in the fisheries field.

Students in the fisheries biology specialization program take courses from several disciplines, including courses in entomology, environmental studies,

mathematics, wildlife and fisheries biology, biology, botany, chemistry, computer sciences, physics, zoology, genetics, and physiology. A marine orientation is also possible in the wildlife major.

NUMBER OF MARINE SCIENCE COURSES: 7 undergraduate 2 graduate

NUMBER OF FACULTY: 10 (3 in fisheries, 7 in wildlife)

RESEARCH FACILITIES: Laboratories for research in fish physiology and ecology are located in Briggs Hall and the Institute of Ecology.

CONTACT:

Peter Moyle
Department of Wildlife and Fisheries Biology
67 Briggs Hall
University of California
Davis, California
95616 (916) 752-2739

or

Joseph Cech
Department of Wildlife and Fisheries Biology
77 Briggs Hall
University of California
Davis, California
95616 (916) 752-3103

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, IRVINE

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.S.

DESCRIPTION: UC Irvine offers an unofficial "biology with marine emphasis" undergraduate degree program. Students working toward a Bachelor of Science degree in biology can chose from several marine science courses to fill the degree requirements, including such courses as Marine Ecology, Phycology, Phytoplankton Biology, Biology of Open Oceans, and Aquatic Productivity.

NUMBER OF MARINE SCIENCE COURSES: 14 undergraduate 14 graduate

NUMBER OF FACULTY: 5

RESEARCH FACILITIES: UC Irvine is located four miles from rocky intertidal shores and one mile from estuarine areas. Research equipment includes numerous environmental growth chambers, specific ion probes, pH meters, oxygen analyzers, an aquarium room, spectrophotometers, microscopes, and photographic equipment.

CONTACT:

Mark M. Littler
Department of Ecology and Evolutionary Biology
University of California
Irvine, California
92171 (714) 833-7112

or

Peter S. Dixon
Department of Ecology and Evolutionary Biology
University of California
Irvine, California
92171 (714) 833-6686

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, IRVINE (cont.)

PROGRAM: DEVELOPMENT AND CELL BIOLOGY with MARINE SPECIALIZATION

DEGREE OFFERED: M.S./ Ph.D.

DESCRIPTION: UC Irvine offers a graduate degree program in development and cell biology with specialization in marine biology. Students can choose from several undergraduate and graduate marine science courses, including Marine Ecology, Applied Marine Ecology, Phycology, Phytoplankton Biology, Aquatic Productivity, and Biology of Open Oceans.

NUMBER OF MARINE SCIENCE COURSES: 14 undergraduate 14 graduate

NUMBER OF FACULTY: 5

RESEARCH FACILITIES: See description on page 193.

CONTACT:

Mark M. Littler
Department of Ecology and Evolutionary Biology
University of California
Irvine, California
92171 (714) 833-7112

or

Peter S. Dixon
Department of Ecology and Evolutionary Biology
University of California
Irvine, California
92171 (714) 833-6686

PROGRAM: ECOLOGY AND EVOLUTIONARY BIOLOGY with MARINE SPECIALIZATION

DEGREE OFFERED: M.S./ Ph.D.

DESCRIPTION: UC Irvine offers a graduate degree program in ecology and evolutionary biology with specialization in marine science. Students can choose from several marine science courses offered through the biology department, including courses in marine ecology, applied marine ecology, phycology, phytoplankton biology, aquatic productivity, and biology of open oceans.

NUMBER OF MARINE SCIENCE COURSES: 14 undergraduate 14 graduate

NUMBER OF FACULTY: 5 (members of the department interested in the marine area)

RSEARCH FACILITIES: See page 193.

CONTACT:

Mark M. Littler
Department of Ecology and Evolutionary Biology
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Irvine, California
92171 (714) 833-7112

or

Peter S. Dixon
Department of Ecology and Evolutionary Biology
University of California
Irvine, California
92171 (714) 833-6686

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FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, SAN DIEGO

PROGRAM: BIOLOGY (with MARINE SPECIALIZATION)

DEGREE OFFERED: B.S./ M.S./ Ph.D.

DESCRIPTION: UC San Diego does not offer an official "biology with marine specialization" degree program. However, students who wish to complete the biology program can choose several marine science courses, mostly offered at nearby Scripps Institution of Oceanography. This flexibility is ideally suited for the student who does not want the more specific marine biology program offered through Scripps, but wants a more general biology program with a lighter emphasis in marine studies.

NUMBER OF MARINE SCIENCE COURSES: 3 undergraduate 1 graduate (36 courses offered at Scripps)

NUMBER OF FACULTY: 59

RESEARCH FACILITIES: See description of Scripps Institution of Oceanography on next page.

CONTACT:

Frank Rokop
Lecturer in Marine Biology
Department of Biology, C-016
University of California, San Diego
La Jolla, California
92093 (714) 452-4770 or 454-3955

RESEARCH FACILITIES:

Scripps Institution of Oceanography is one of the oldest, largest, and most important centers for research, graduate training, and public service in the marine sciences. The institution occupies 64 buildings on 230 acres. The staff numbers approximately 1,200, including more than 200 graduate students.

The scientific scope of research conducted at Scripps embraces physical, chemical, geological, geophysical, and biological studies of the oceans. Continuing investigations are conducted of the topography and composition of the ocean bottom, of waves and currents, of the flow and interchange of matter between seawater and the ocean bottom or the atmosphere, and of life in the sea.

The education program at Scripps is at the graduate level only, and studies are marked by a high degree of interdisciplinary and international collaboration. Academic work is conducted through an organizational segment of the institution known as the SIO Department and its seven curricular groups: biological oceanography, physical oceanography, marine biology, geological sciences, marine chemistry, geophysics, and applied ocean sciences. Approximately eighty professors are complemented by an academic staff of more than a hundred research scientists who teach on a less frequent basis.

Scripps maintains five major ships at sea. The fleet sails on limited-objective trips and far-flung expeditions. The fleet includes the Melville, Scripps's largest ship; the research vessel Thomas Washington; the New Horizon, the newest addition to the fleet; and, smallest of them all, the Ellen B. Scripps. Several research platforms are also used extensively.

Research funds from sources outside the university are primarily federal, and cover a wide latitude of marine research. The general research effort is conducted by three divisions, designated the Marine Biology Research Division, the Geological Research Division, and the Ocean Research Division. The diversity of their work is extended by three special-purpose laboratories: the Marine Physical Laboratory, the Physological Research Laboratory, and the Visibility Laboratory; and by other specalized groups such as the Deep Sea Drilling Project and the Marine Life Research Group, sponsored by the State of California; and components of two University-wide institutes, the Institute of Marine Resources and the Institute of Geophysics and Planetary Physics. A ship operations and marine technical support unit provide essential services and facilities to all research units of the institution, and also administer the scientific collections.

Closely affiliated with Scripps is the University of California's La Jolla Laboratory of the Institute of Marine Resources (IMR). The objective of the Institute is to acquire and disseminate knowledge of the sea's resources, not only the contents and nature of the ocean and its boundaries, but also the social, legal, economic, and political aspects and constraints of its uses. The Institute's programs involve research, education, and public service in relation to man's uses of marine resources, including food science, marine products transportation, recreation, waste disposal, and production of energy, and the processes and conflicts that extend or limit these uses.

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, SAN DIEGO: SCRIPPS INSTITUTION OF OCEANOGRAPHY (cont.)

Located on the San Diego campus is the Southwest Fisheries Center (SFC), one of thirty major laboratories and centers operated by the National Marine Fisheries Service, a component of the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce. SFC is also the headquarters for the Inter-America Tropical Tuna Commission.

CONTACT:

Richard H. Rosenblatt, Chairman
Graduate Department of SIO, A-008
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, California
92093 (714) 452-2199

PROGRAM: APPLIED OCEAN SCIENCES

DEGREE OFFERED: M.S./ Ph.D. in OCEANOGRAPHY, EARTH SCIENCES, or MARINE BIOLOGY

DESCRIPTION: The Graduate Department of the Scripps Institution of Oceanography does not offer an official degree in "applied ocean sciences." Instead, they offer applied ocean sciences as a concentration area for students working toward a graduate degree in oceanography, marine biology, or earth sciences. The program is designed to produce oceanographers who are knowledgeable about modern engineering and engineers who know about the oceans. Research activities include studies of deep circulation; deep-sea autonomous vehicles, instruments, basic control devices, and special collecting gear; seismic surveys of the mantle; crustal displacements associated with earthquakes; deep-sea drilling; design and construction of special-purpose ocean vehicles (ships, submarines, platforms); sonar systems and sonar signal processing equipment; underwater communication and signal detection; underwater photography and television; and beach erosion.

NUMBER OF MARINE SCIENCE COURSES: Not applicable--interdepartmental program involving the Departments of Applied Mechanics and Engineering Sciences and Electrical Engineering and Computer Sciences.

NUMBER OF FACULTY: Not applicable--interdepartmental program

RESEARCH FACILITIES: See description on page 200.

CONTACT:

Victor Anderson
Scripps Institution of Oceanography, P-001
University of California, San Diego
La Jolla, California
92093 (714) 452-2304

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, SAN DIEGO: SCRIPPS INSTITUTION OF OCEANOGRAPHY (cont.)

PROGRAM: BIOLOGICAL OCEANOGRAPHY

DEGREE OFFERED: M.S./ Ph.D. in Oceanography

DESCRIPTION: The Graduate Department of the Scripps Institution of Oceanography offers a graduate degree program in oceanography with emphasis in biological oceanography. The program concerns the interactions of populations of marine organisms with one another and with their physical and chemical environment. Studies include those in physical oceanography, marine chemistry, marine geology, and biology. Research activities include studying the factors influencing primary and secondary productivity and nutrient regeneration, food-chain dynamics, community ecology of benthic and pelagic forms, population dynamics, habitat changes and disruption, fishery biology, systematics, evolution, biogeography, behavior as it affects distribution, and sampling problems.

NUMBER OF MARINE SCIENCE COURSES: 0 undergraduate 14 graduate

NUMBER OF FACULTY: 11

RESEARCH FACILITIES: See description on page 200.

CONTACT:

James T. Enright
Scripps Institution of Oceanography, A-002
University of California, San Diego

La Jolla, California
92093 (714) 452-2143

PROGRAM: GEOLOGICAL SCIENCES

DEGREE OFFERED: M.S./ Ph.D. in Earth Sciences or Oceanography

DESCRIPTION: The Geological Sciences Curricular Group of the Scripps Institution of Oceanography offers programs leading to a graduate degree in earth sciences or oceanography. Principal subprograms within the group are marine geology, petrology, and geochemistry. Marine geology is the study of the origin, properties, and history of ocean basins and the geological processes that affect them. Research areas include tectonics and volcanism; geomorphology, structure, and deformation of the oceanic crust and continental margins, utilizing both geophysical and geological techniques; deep sea and continental margin sedimentation, stratigraphy, and paleontology; and beach and nearshore processes.

Petrology is the study of the origin and history of the rock complexes of the earth's crust and upper mantle, with emphasis on the igneous, metamorphic, and sedimentary rocks of the ocean basins and their margins, the characteristics and interrelations of the oceanic and continental crust, and studies of lunar and meteoritic materials.

The geochemistry program is designed for students with undergraduate degrees in either geology or chemistry. Areas of advanced study and research include the

geochemistry of the ocean, the atmosphere, and the solid earth; nuclear geochemistry; circulation and mixing of oceanic water masses based on carbon, oxygen, carbon-14, radium, radon, stable isotopes, and rare gases; volcanic and geothermal phenomena; the interaction of sediments with seawater and interstitial waters; geochemical cycles; and the history and composition of the ocean and sedimentary rocks.

NUMBER OF MARINE SCIENCE COURSES: 0 undergraduate 35 graduate

NUMBER OF FACULTY: 18

RESEARCH FACILITIES: See page 200.

CONTACT:

Miriam Kastner
Scripps Institution of Oceanography, A-012
University of California, San Diego
La Jolla, California
92093 (714) 452-2065

PROGRAM: GEOPHYSICS

DEGREE OFFERED: M.S./ Ph.D. in Earth Sciences or Oceanography

DESCRIPTION: The Scripps Institution of Oceanography offers a graduate degree program in earth sciences and in oceanography, through which students may specialize in geophysics. There is no single course of study appropriate to the geophysics curriculum; instead, the student's individual interests will dictate course work in seismology, geomagnetism, etc. Every student will be required to have knowledge in one or more of the ocean sciences.

Geophysics emphasizes the application of general experimental and theoretical methods of physics to fundamental problems in the atmosphere, oceans, and interior of the earth, and in the solar system. Research interests within this curricular group include: magnetohydrodynamic phenomena in the earth's core, hydrodynamics of oceans and atmospheres, geophysical inverse problems, theoretical seismology, the design of geophysical arrays, multichannel data-processing methods, nonlinear tidal prediction, long-period resonant and equilibrium fluctuations in the earth and its oceans, radiative transfer in the sea and the atmosphere, interactions of nonlinear wave fields, studies of oceanic crustal structure, acoustic

propagation in the oceans, interpretation of regional geomagnetic data, processes of ocean-floor spreading, and irreversible thermodynamics.

NUMBER OF MARINE SCIENCE COURSES: 0 undergraduate 15 graduate

NUMBER OF FACULTY: 13

RESEARCH FACILITIES: See page 200.

CONTACT:

Richard Haubrich
Scripps Institution of Oceanography, A-025
University of California, San Diego
La Jolla, California
92093 (714) 452-2880

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, SAN DIEGO: SCRIPPS INSTITUTION OF OCEANOGRAPHY (cont.)

PROGRAM: MARINE BIOLOGY or OCEANOGRAPHY

DEGREE OFFERED: M.S./ Ph.D.

DESCRIPTION: The Graduate Department of the Scripps Institution of Oceanography offers a graduate degree program in marine biology. The program concerns the physiological and biochemical processes in marine organisms, their genetic relationships, and the relationship between them and their environment, both biotic and physical. Research activities include microbiology, ultrastructure, photobiology, barobiology, cardiovascular physiology, comparative biochemistry, comparative and cellular physiology, neurophysiology and behavior, systematics, distribution, ecology, developmental biology, and evolution of marine animals and plants.

NUMBER OF MARINE SCIENCE COURSES: 0 undergraduate 22 graduate

NUMBER OF FACULTY: 24 (specifically marine biology)

RESEARCH FACILITIES: See page 200.

CONTACT:

George N. Somero
Scripps Institution of Oceanography, A-002
University of California, San Diego
La Jolla, California
92093 (714) 452-2727

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, SAN DIEGO: SCRIPPS INSTITUTION OF OCEANOGRAPHY (cont.)

PROGRAM: MARINE CHEMISTRY

DEGREE OFFERED: M.S./ Ph.D. in Oceanography

DESCRIPTION: The Graduate Department of the Scripps Institution of Oceanography does not offer a degree in "marine chemistry." Instead, they offer marine chemistry as a concentration area for students working toward a graduate degree in oceanography, marine biology, or earth sciences. The program focuses on the interactions of the components of seawater with the atmosphere, with the sedimentary solid phases, and with plants and animals. Research programs include carbon system investigations, natural products, chemical interactions between marine organisms, physical and inorganic chemistry of sediment water systems, organic chemistry in the marine environment, noble gas distribution in sea water, and pollutant effects on the marine environment.

NUMBER OF MARINE SCIENCES COURSES: 0 undergraduate 9 graduate

NUMBER OF FACULTY: 14

RESEARCH FACILITIES: See page 200.

CONTACT:

D. John Faulkner
Scripps Institution of Oceanography, A-012-F
University of California, San Diego
La Jolla, California
92093 (714) 452-4259

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FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, SAN DIEGO: SCRIPPS INSTITUTION OF OCEANOGRAPHY (cont.)

PROGRAM: PHYSICAL OCEANOGRAPHY

DEGREE OFFERED: M.S./ Ph.D. in Oceanography

DESCRIPTION: The Graduate Department of the Scripps Institution of Oceanography offers a graduate degree program in oceanography with emphasis in physical oceanography. The program deals with the mechanisms of energy transfer through the sea and across its boundaries, and with the physical interactions of the sea with its surroundings. Research activities include study of the general circulation of the oceans, including the relations of ocean currents to driving forces and constraints of the ocean basins; fluctuations of currents, and the transport of properties; the mechanisms of energy transport; momentum and physical substance transport; wind wave, internal wave, tsunami, and planetary wave properties; sea optical and acoustic properties; and surf influence on nearshore current and sediment transport.

NUMBER OF MARINE SCIENCE COURSES: 0 undergraduate 10 graduate

NUMBER OF FACULTY: 14 (specifically oceanography)

RESEARCH FACILITIES: See page 200.

CONTACT:

Myrl Hendershott
Scripps Institution of Oceanography, A-030
University of California, San Diego
La Jolla, California
92093 (714) 452-2072

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, SANTA BARBARA

PROGRAM: AQUATIC BIOLOGY

DEGREE OFFERED: B.A.

DESCRIPTION: UC Santa Barbara offers a Bachelor of Arts degree program in aquatic biology. The major provides opportunities for students with interests in marine biology, biological oceanography, limnology, marine and fresh water ecology, and population biology of aquatic organisms. Opportunities for concentration in certain of these subjects are provided by a broad range of courses offered at the upper-division level.

In preparation for the major, students must take several lower-division courses in biology, chemistry, physics, and mathematics. Upper-division credit must include courses taken from several categories, including aquatic animals, aquatic plants, physiology, genetics, development, and ecology.

NUMBER OF MARINE SCIENCE COURSES: 32 undergraduate 4 graduate

NUMBER OF FACULTY: 49

RESEARCH FACILITIES: UCSB's Marine Science Institute (MSI) is an interdepartmental administrative agency which assists and encourages faculty, professional researchers, and students in marine research. The MSI administers research projects involving faculty and graduate students from six disciplines. A core of research activity is focused on the resources of the California coast and on their wise management. A significant

portion of the systemwide Sea Grant program is centered in the Institute. The MSI specifically encourages and promotes basic and applied research leading to a better understanding of the local marine environment.

Marine laboratories in several buildings are provided with seawater service, from a new seawater system, and are suitably equipped for needs in a broad range of biological and other disciplines. Field-oriented work is supported by boats suitable for work in coastal waters (including those around the Santa Barbara Channel Islands), and by diving and other field equipment. The university operates a field station on Santa Cruz Island, the largest of the northern Channel Islands.

Other research facilities used by UCSB include vessels operated by the Scripps Institution of Oceanography and the University of Southern California, and facilities at Hopkins Marine Station, Pacific Grove.

CONTACT:

Adrian Wenner
Department of Biological Science
University of California
Santa Barbara, California
93106 (805) 961-2838

or

Henry Offen, Director
Marine Science Institute
University of California
Santa Barbara, California
93106 (805) 961-3764

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, SANTA BARBARA (cont.)

PROGRAM: BIOLOGY with AQUATIC AND POPULATION EMPHASIS

DEGREE OFFERED: M.A./ Ph.D.

DESCRIPTION: UC Santa Barbara offers a graduate degree program in biology with emphasis in aquatic and population biology. Students can choose between a number of specialized areas in aquatic and population biology, including biology of arthropods, biological oceanography and limnology, comparative immunology, ichthyology, parasitology, and population ecology.

NUMBER OF MARINE SCIENCE COURSES: 32 undergraduate 4 graduate

NUMBER OF FACULTY: 49

RESEARCH FACILITIES: See description on page 216.

CONTACT:

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Department of Biological Science
University of California
Santa Barbara, California
93106 (805) 961-2838

or

Henry Offen, Director
Marine Science Institute
University of California
Santa Barbara, California
93106 (805) 961-3764

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, SANTA BARBARA (cont.)

PROGRAM: BIOLOGY with MARINE BIOLOGY SPECIALIZATION

DEGREE OFFERED: M.A./ Ph.D.

DESCRIPTION: UC Santa Barbara offers a graduate-level degree program in biology with specialization in marine biology. Students can choose from courses in a number of specialized marine biology areas, including marine toxins, physiology of algae, marine phytoplankton biogeography and productivity, molecular marine biology, ecological physiology, ichthyology, marine zooplankton and symbiosis.

NUMBER OF MARINE SCIENCE COURSES: 25 undergraduate 9 graduate

NUMBER OF FACULTY: 18

RESEARCH FACILITIES: See page 216.

CONTACT:

Adrian Wenner

Department of Biological Science
University of California
Santa Barbara, California
93106 (805) 961-2838

or

Henry Offen, Director
Marine Science Institute
University of California
Santa Barbara, California
93106 (805) 961-3764

PROGRAM: BOTANY with MARINE BIOLOGY EMPHASIS

DEGREE OFFERED: M.A.

ADESCRIPTION: UC Santa Barbara offers a graduate-level degree program in botany with emphasis in marine biology. Students can choose from courses in a number of specialized marine biology areas, including phycology; systematics, morphology, structure and evolution of aquatic diatoms; aquatic diatom laboratory; marine toxins; physiology of algae; marine phytoplankton biogeography and productivity; molecular marine biology; ecological physiology; ichthyology; marine zooplankton and symbiosis.

NUMBER OF MARINE SCIENCE COURSES: 26 undergraduate 11 graduate

NUMBER OF FACULTY: 24

RESEARCH FACILITIES: See page 216.

CONTACT:

Adrian Wenner
Department of Biological Science
University of California
Santa Barbara, California
93106 (805) 961-2838

or

Henry Offen, Director
Marine Science Institute
University of California
Santa Barbara, California

93106 (805) 961-3764

PROGRAM: ZOOLOGY with MARINE BIOLOGY EMPHASIS

DEGREE OFFERED: M.A.

DESCRIPTION: UC Santa Barbara offers a graduate-level degree program in zoology with emphasis in marine biology. Students can choose from courses in a number of specialized marine biology areas, including invertebrate zoology, aquatic arthropods, biology of amphibians and reptiles, systematics of fishes, ichthyology, marine toxins, physiology of algae, marine phytoplankton biogeography and productivity, molecular marine biology, ecological physiology, marine zooplankton, symbiosis.

NUMBER OF MARINE SCIENCE COURSES: 26 undergraduate 11 graduate

NUMBER OF FACULTY: 24

RESEARCH FACILITIES: See page 216.

CONTACT:

Adrian Wenner
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Santa Barbara, California
93106 (805) 961-2838

or

Henry Offen, Director
Marine Science Institute
University of Calif

Santa Barbara, California
93106 (805) 961-3764

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA,
SANTA CRUZ

PROGRAM: BIOLOGY (with MARINE EMPHASIS)

DEGREE OFFERED: B.A./ M.A./ Ph.D.

DESCRIPTION: UC Santa Cruz does not offer an official "biology with marine emphasis" degree program. However, with the large variety of marine facilities on and near the campus, and with the flexibility of the biology major, students interested in marine biology can easily design a four-year program that reflects a strong marine biology emphasis.

Several of the faculty at UCSC are interested in the marine sciences. As a result, undergraduate and graduate students can do research in several marine-oriented fields, as in higher marine vertebrates (pinnepeds and cetaceans), coastal zone processes, marine geology of continental margins and island arcs, oceanography, marine ecology, planktology, marine plants, water quality, and marine resources.

Students can do research through UC Santa Cruz's Center for Coastal Marine Studies (CCMS). CCMS operates the Joseph M. Long Marine Laboratory, located on the coast less than ten minutes away from the campus.

Several marine studies courses are offered at UCSC in disciplines other than biology, such as chemistry, earth sciences, environmental studies, and economics. Particular attention is given to the California coastal zone as a research and teaching field resource,

although faculty and students work from Alaska to the Antarctic.

NUMBER OF MARINE SCIENCE COURSES: 10 undergraduate 6 graduate

NUMBER OF FACULTY: 28

RESEARCH FACILITIES: The Office of the Center for Coastal Marine Studies is on campus. The Center has analytical laboratories for marine chemistry, biology, and geology; an oceanography cruise-staging room, and culture rooms for invertebrates and algae. CCMS owns a Boston whaler for nearshore research, and the 40-foot research vessel Scammon, which is well-equipped for bay and nearshore coastal research and instruction. Faculty and students also work in a variety of places around the world aboard larger oceanographic research vessels.

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, SANTA CRUZ

RESEARCH FACILITIES:

(cont.) The Joseph M. Long Marine Laboratory has running salt-water capabilities that greatly extend the opportunities for research and instruction. Because of the laboratory's proximity to the campus, work done there can easily be incorporated into the daily instructional activities on campus. Facilities include two research laboratory buildings and outdoor tanks for observations on small marine mammals.

In cooperation with the California Department of Parks and Recreation, faculty and students with particular interest in the study of marine vertebrates can do research on Ano Nuevo Island, just north of Santa Cruz. Ano Nuevo is one of the largest elephant-seal and sea-lion rookeries on the Pacific coast. Research of these mammals includes studying their population numbers and dynamics, migratory behavior, and their role in the food web of the California coastal system.

CONTACT:

William Doyle, Director
Center for Coastal Marine Studies
Applied Sciences Building
University of California
Santa Cruz, California
95064 (408) 429-2464 or 429-4596

FOUR-YEAR PUBLIC

UNIVERSITY OF CALIFORNIA, SANTA CRUZ (cont.)

PROGRAM:

ENVIRONMENTAL STUDIES with MARINE AFFAIRS EMPHASIS (INDIVIDUAL PROGRAM)

DEGREE OFFERED: B.A.

DESCRIPTION: UC Santa Cruz offers a Bachelor of Arts degree program in an environmental studies individual program with a marine affairs emphasis. The environmental studies individual program is available for those students desiring more flexibility in designing their programs than may be possible under the established environmental studies pathways.

All students with a marine emphasis are directed to the Marine Affairs Committee, which acts as a clearing house for incoming marine-oriented students. Disciplinary curriculum is examined, the slant on environmental affairs determined, and then the student is routed to the Environmental Studies Department for further guidance.

NUMBER OF MARINE SCIENCE COURSES: Not applicable--individual major

NUMBER OF FACULTY: Not applicable--individual major

RESEARCH FACILITIES: See page 228.

CONTACT:

Kenneth S. Norris,
Board of Environmental Studies
Clark Kerr Hall
University of California
Santa Cruz, California
95064 (408) 429-2836

EXPLANATION OF CHARTS AND TABLES

TABLE 1: "Institutions and Affiliated Marine Facilities" lists alphabetically the two- and four-year institutions with marine research affiliations. "Affiliated marine facilities" includes any marine stations, centers, institutes, or laboratories that complement an institution's marine science program. The sponsoring institution is listed parenthetically beneath each marine research facility. For example, the Bolinas Marine Station (College of Marin), is owned and operated by the College of Marin, and the Center for Marine Studies (SCOSC) is operated by the Southern California Ocean Studies Consortium.

TABLE 2: "Marine Facilities and Affiliated Institutions" cross-references the marine facilities and the two- and four-year institutions that use them.

CHART 1: This chart identifies each four-year public and private institution that offers a degree program in marine science, be it a minor in oceanography or a Ph.D. in ocean engineering. Private institutions are listed first, with public institutions following.

Table 1

INSTITUTIONS AND AFFILIATED MARINE FACILITIES

TWO-YEAR

COLLEGE OF MARIN	BOLINAS MARINE STATION (College of Marin)
SKYLINE COLLEGE	MARINE ECOLOGICAL INSTITUTE (Independent)

FOUR-YEAR PRIVATE

CALIFORNIA INSTITUTE OF TECHNOLOGY	SANTA CATALINA MARINE BIOLOGICAL LABORATORY (USC) SCRIPPS INSTITUTION OF OCEANOGRAPHY (UCSD) WILLIAM G. KERCKHOFF MARINE LABORATORY (CIT)
COLLEGE OF NOTRE DAME	MARINE ECOLOGICAL INSTITUTE (Independent)
LOMA LINDA UNIVERSITY	WALLA WALLA MARINE STATION (Walla Walla College, Washington)
LOYOLA MARYMOUNT UNIVERSITY	LOYOLA MARYMOUNT UNIVERSITY BAJA CALIFORNIA BIOLOGICAL STATION (LMU)
OCCIDENTAL COLLEGE	SANTA CATALINA MARINE BIOLOGICAL LABORATORY (USC)
PACIFIC UNION COLLEGE	MENDOCINO BIOLOGICAL FIELD STATION (Pacific Union College)

INSTITUTIONS AND AFFILIATED MARINE FACILITIES (cont.)

FOUR-YEAR PRIVATE (cont.)

POMONA COLLEGE	OREGON INSTITUTE OF MARINE BIOLOGY (Oregon)
	WOODS HOLE (Massachusetts)
SAINT MARY'S COLLEGE OF CALIFORNIA	SANTA CATALINA MARINE BIOLOGICAL LABORATORY (USC)
	WOODS HOLE (Massachusetts)
STANFORD UNIVERSITY	HOPKINS MARINE STATION (Stanford)
UNIVERSITY OF SOUTHERN CALIFORNIA	CATALINA MARINE SCIENCE CENTER (USC) SANTA CATALINA MARINE BIOLOGICAL LABORATORY (USC)
	INSTITUTE FOR MARINE AND COASTAL STUDIES (USC)
	THE ALLAN HANCOCK FOUNDATION (USC)

FOUR-YEAR PUBLIC

CALIFORNIA STATE UNIVERSITY, DOMINGUEZ HILLS	MOSS LANDING MARINE LABORATORIES (CSU and Colleges Consortium)
CALIFORNIA POLYTECHNIC STATE UNIVERSITY, POMONA	CENTER FOR OCEAN SCIENCE STUDIES (SCOSC)

INSTITUTIONS AND AFFILIATED MARINE FACILITIES (cont.)

FOUR-YEAR PUBLIC (cont).

CALIFORNIA STATE COLLEGE, STANISLAUS	MOSS LANDING MARINE LABORATORIES (CSU and Colleges Consortium)
CALIFORNIA STATE UNIVERSITY, FRESNO	MOSS LANDING MARINE LABORATORIES (CSU and Colleges Consortium)
CALIFORNIA STATE UNIVERSITY, FULLERTON	CENTER FOR OCEAN SCIENCE STUDIES (SCOSC)
CALIFORNIA STATE UNIVERSITY, HAYWARD	MOSS LANDING MARINE LABORATORIES (CSU and Colleges Consortium
CALIFORNIA STATE UNIVERSITY, LONG BEACH	CENTER FOR OCEAN SCIENCE STUDIES (SCOSC)
CALIFORNIA STATE UNIVERITY, LOS ANGELES	CENTER FOR OCEAN SCIENCE STUDIES (SCOSC)
CALIFORNIA STATE UNIVERSITY, SACRAMENTO	MOSS LANDING MARINE LABORATORIES (CSU and Colleges Consortium)

INSTITUTIONS AND AFFILIATED MARINE FACILITIES (cont.)

FOUR-YEAR PUBLIC (cont.)

HUMBOLDT STATE UNIVERSITY	TELONICHER MARINE SCIENCES LABORATORY (Humboldt State University)
*NAVAL POSTGRADUATE SCHOOL	PACIFIC MARINE CENTER (NOAA--Seattle, Washington)
	FLEET NUMERICAL OCEANOGRAPHIC CENTER (Monterey)
	NAVAL ENVIRONMENTAL PREDICTION RESEARCH FACILITY (Monterey)
SAN DIEGO STATE UNIVERSITY	CENTER FOR MARINE STUDIES (SDSU)
	SAN DIEGO STATE UNIVERSITY MARINE LABORATORY (SDSU)
	SCRIPPS INSTITUTION OF OCEANOGRAPHY (UCSD)
	ENCINA LABORTORY (SDSU)
SAN FRANCISCO STATE UNIVERSITY	MOSS LANDING MARINE LABORATORIES (CSU and College Consortium)
	TIBURON CENTER FOR ENVIRONMENTAL STUDIES (SFSU)
SAN JOSE STATE UNIVERSITY	MOSS LANDING MARINE LABORATORIES (CSU and Colleges Consortium)

INSTITUTIONS AND AFFILIATED MARINE FACILITIES (cont.)

FOUR-YEAR PUBLIC (cont.)

UNIVERSITY OF CALIFORNIA, BERKELEY.....	BODEGA MARINE LABORATORY (UC)
	RICHMOND FIELD STATION (UCSB)
	SCRIPPS INSTITUTION OF OCEANOGRAPHY (UCSD)
	CENTER FOR COASTAL MARINE STUDIES (UCSC)
	HOPKINS MARINE STATION (STANFORD)
	(Access to Golden Bear, owned by The California Maritime Academy)
UNIVERSITY OF CALIFORNIA, DAVIS.....	INSTITUTE OF MARINE RESOURCES (UC)
	BODEGA MARINE LABORATORY (UC)
UNIVERSITY OF CALIFORNIA, SAN DIEGO.....	INSTITUTE OF MARINE RESOURCES (UC)
	SCRIPPS INSTITUTION OF OCEANOGRAPHY (UCSD)
	SOUTHWEST FISHERIES CENTER (NOAA-NMFS)

INSTITUTIONS AND AFFILIATED MARINE FACILITIES (cont.)

FOUR-YEAR PUBLIC (cont.)

UNIVERSITY OF CALIFORNIA, SANTA BARBARA	MARINE SCIENCE INSTITUTE (UCSB)
	SCRIPPS INSTITUTION OF OCEANOGRAPHY (UCSD)
	HOPKINS MARINE STATION (Stanford)
	INSTITUTE OF MARINE RESOURCES (UC)
UNIVERSITY OF CALIFORNIA SANTA CRUZ	ANO NUEVO ISLAND (California Dept. of Parks and Recreation)
	CENTER FOR COASTAL MARINE STUDIES (UCSC)
	JOSEPH M. LONG COASTAL MARINE LABORATORY (UCSC)
	INSTITUTE OF MARINE RESOURCES (UC)

Table 2

MARINE FACILITIES AND AFFILIATED INSTITUTIONS

THE ALLAN HANCOCK FOUNDATION	UNIVERSITY OF SOUTHERN CALIFORNIA (USC)
ANO NUEVO ISLAND (Calif. Dept of Parks and Recreation)	UC SANTA CRUZ
BODEGA MARINE LABORATORY (University of California)	UC BERKELEY UC DAVIS
BOLINAS MARINE STATION (College of Marin)	COLLEGE OF MARIN
CATALINA MARINE SCIENCE CENTER (USC)	UNIVERSITY OF SOUTHERN CALIFORNIA
CENTER FOR COASTAL MARINE STUDIES (UCSC)	UC SANTA CRUZ UC BERKELEY
CENTER FOR MARINE STUDIES (SDSU)	SAN DIEGO STATE UNIVERSITY
CENTER FOR OCEAN SCIENCE STUDIES (Southern Calif. Ocean Studies Consortium (SCOSC)	CSU, DOMINGUEZ HILLS CSU, FULLERTON CSU, LONG BEACH CSU, LOS ANGELES CSU, NORTHRIDGE CAL POLY, POMONA
ENCINA LABORATORY	SAN DIEGO STATE UNIVERSITY (SDSU)

MARINE FACILITIES AND AFFILIATED INSTITUTIONS (cont.)

FLEET NUMERICAL OCEANOGRAPHIC CENTER..... Monterey	NAVAL POSTGRADUATE SCHOOL
HOPKINS MARINE STATION..... (Stanford University)	STANFORD UNIVERSITY UC BERKELEY UC SANTA BARBARA
INSTITUTE FOR MARINE AND COASTAL STUDIES.....	UNIVERSITY OF SOUTHERN CALIFORNIA (USC)
INSTITUTE OF MARINE RESOURCE..... (University of California)	UC DAVIS UC SAN DIEGO UC SANTA BARBARA UC SANTA CRUZ
JOSEPH M. LONG COASTAL MARINE LABORATORY (UCSC).....	UC SANTA CRUZ
LOYOLA MARYMOUNT UNIVERSITY BAJA CALIFORNIA BIOLOGICAL STATION.....	LOYOLA MARYMOUNT UNIVERSITY
MARINE ECOLOGICAL INSTITUTE..... (Independent)	SKYLINE COLLEGE COLLEGE OF NOTRE DAME
MARINE SCIENCE INSTITUTE..... (UCSB)	UC SANTA BARBARA

MARINE FACILITIES AND AFFILIATED INSTITUTIONS (cont.)

MENDOCINO BIOLOGICAL FIELD STATION..... (Pacific Union College)	PACIFIC UNION COLLEGE
MOSS LANDING MARINE LABORATORIES..... (CSU and Colleges Consortium)	CSU, DOMINGUEZ HILLS CSU, FRESNO CSU, HAYWARD CSU, SACRAMENTO SAN FRANCISCO STATE UNIVERSITY SAN JOSE STATE UNIVERSITY CSU, STANISLAUS
NAVAL ENVIRONMENTAL PREDICTION RESEARCH FACILITY (Monterey).....	NAVAL POSTGRADUATE SCHOOL
PACIFIC MARINE CENTER..... (NOAA-Seattle Washington)	NAVAL POSTGRADUATE SCHOOL
RICHMOND FIELD STATION..... (UCB)	UC BERKELEY
SAN DIEGO STATE UNIVERSITY..... MARINE LABORATORY (SDSU)	SAN DIEGO STATE UNIVERSITY

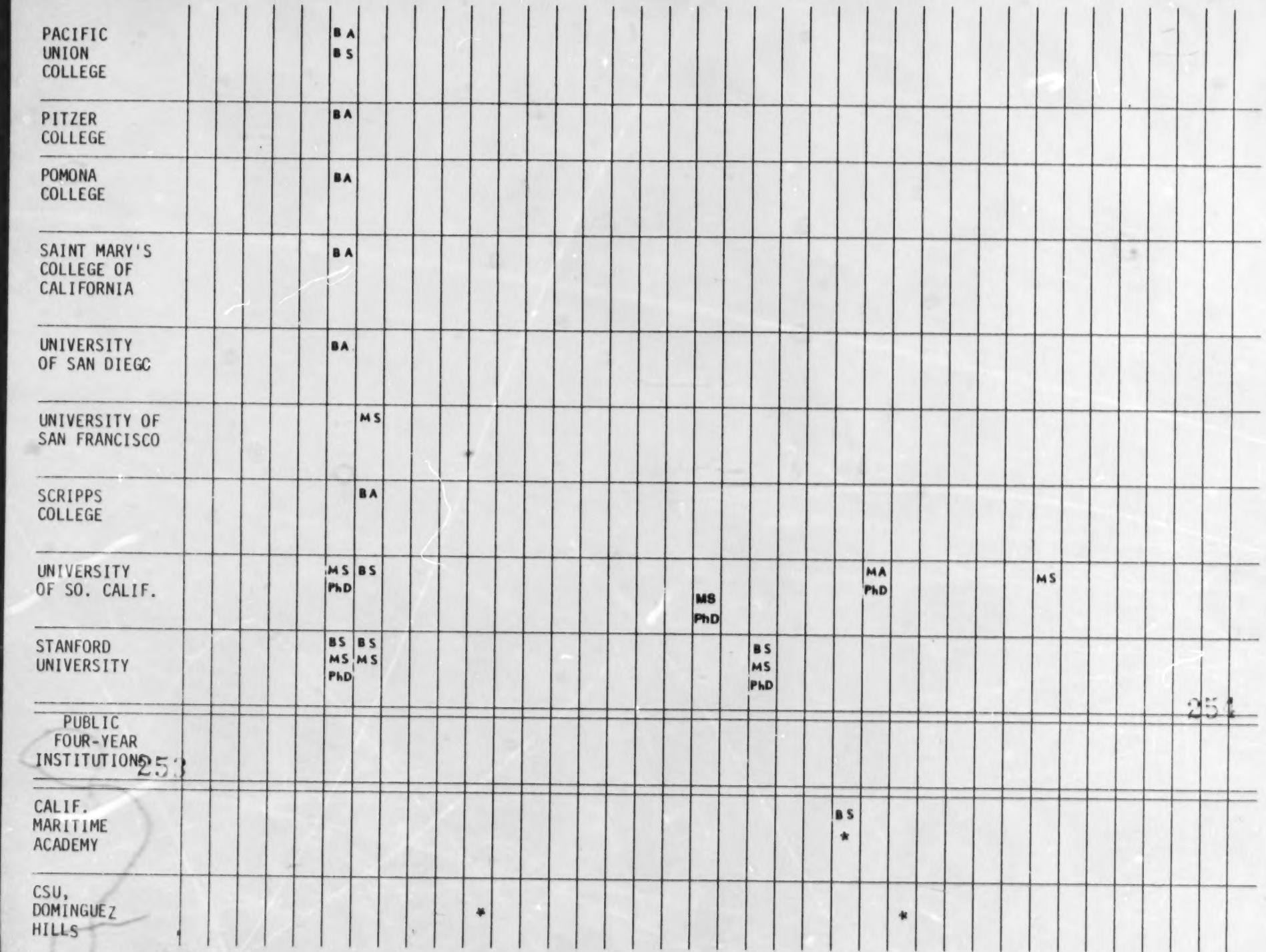
MARINE FACILITIES AND AFFILIATED INSTITUTIONS (cont.)

SANTA CATALINA MARINE BIOLOGICAL LABORATORY (USC) (USC)	CALIFORNIA INSTITUTE OF TECHNOLOGY OCCIDENTAL COLLEGE SAINT MARY'S COLLEGE OF CALIFORNIA UNIVERSITY OF SOUTHERN CALIFORNIA
SCRIPPS INSTITUTION OF OCEANOGRAPHY (UCSD) (UCSD)	CALIFORNIA INSTITUTE OF TECHNOLOGY SAN DIEGO STATE UNIVERSITY UC BERKELEY UC SAN DIEGO UC SANTA BARBARA
SOUTHWEST FISHERIES CENTER (NOAA-NFS)	UC SAN DIEGO
TELONICHER MARINE SCIENCES LABORATORY (Humboldt State University)	HUMBOLDT STATE UNIVERSITY
TIBURON CENTER FOR ENVIRONMENTAL STUDIES	SAN FRANCISCO STATE UNIVERSITY
WILLIAM G. KERCHOFF MARINE LABORATORY (CIT)	CALIFORNIA INSTITUTE OF TECHNOLOGY

CHART 1

PRIVATE FOUR-YEAR INSTITUTIONS

DEGREE PROGRAM	CALIF. INST. OF TECHNOLOGY	CLAREMONT MEN'S COLLEGE	DOMINICAN COLLEGE OF SAN RAFAEL	IMMACULATE HEART COLLEGE	LOMA LINDA UNIVERSITY	LOYOLA MARYMOUNT UNIVERSITY	MT. ST. MARY'S COLLEGE	COLLEGE OF NOTRE DAME	OCCIDENTAL COLLEGE
ANIMAL SCIENCE									
AQUATIC BIOLOGY									
BIO. OCEANOGRAPHY									
BIO. w/AQUA. EMP.									
BIO. w/ENV'L EMP.									
BIO. w/MAR. EMP.	BS MS PhD	BA	BA	BA	MA PhD	BS	BA BS	AA BA BS MA	BA MA
BOT. w/MAR. EMP.									
CHEM. w/MAR. EMP.									
CHEM. w/OCEAN. EMP.									
EARTH SCI. /ENV. GEO.									
EARTH MARINE SCIENCE									
ECOL. & EVOL. BIO									
ECON. w/MAR. EMP.									
ENG. w/MAR. EMP.									
ENG. w/OCEAN OPT.	BS MS PhD								
ENV'L ST. w/MAR. AFF.	BS MS PhD								
FISHERIES									
GEOG. w/MAR. EMP.									
GEOL. w/MAR. EMP.									
GEOL. w/OCEAN EMP.									
GEOPHYSICS	BS MS PhD								
MARINE BIOLOGY									BA MA
MARINE CHEMISTRY									
MAR. ENG. TECH.									
MARINE POLICY									
MARINE SCIENCE									
MICROBIO. w/MAR. EMP.									
NAT. ENVIRONMENTS									
NAT. RES. w/MAR. EMP.									
NAVAL ARCHITECTURE									
OCEAN ENG.									
OCEAN SCI. (APPLIED)									
OCEANOGRAPHY									
PALEONTOLOGY									
PHYS. OCEANOGRAPHY									
POLITICS w/MARINE EMP.									
WILDLIFE & FISHERIES									
ZOOL. w/MAR. EMP.									


PACIFIC UNION COLLEGE
BA
BS
PITZER COLLEGE
BA
POMONA COLLEGE
BA
SAINT MARY'S COLLEGE OF CALIFORNIA
BA
UNIVERSITY OF SAN DIEGO
BA
UNIVERSITY OF SAN FRANCISCO
MS
SCRIPPS COLLEGE
BA
UNIVERSITY OF SO. CALIF.
MS
PhD
BS
MS
PhD
MA
PhD
MS
STANFORD UNIVERSITY
BS
MS
PhD
BS
MS
BS
MS
PhD
PUBLIC FOUR-YEAR INSTITUTIONS
CALIF. MARITIME ACADEMY
BS
*
CSU, DOMINGUEZ HILLS
*
*

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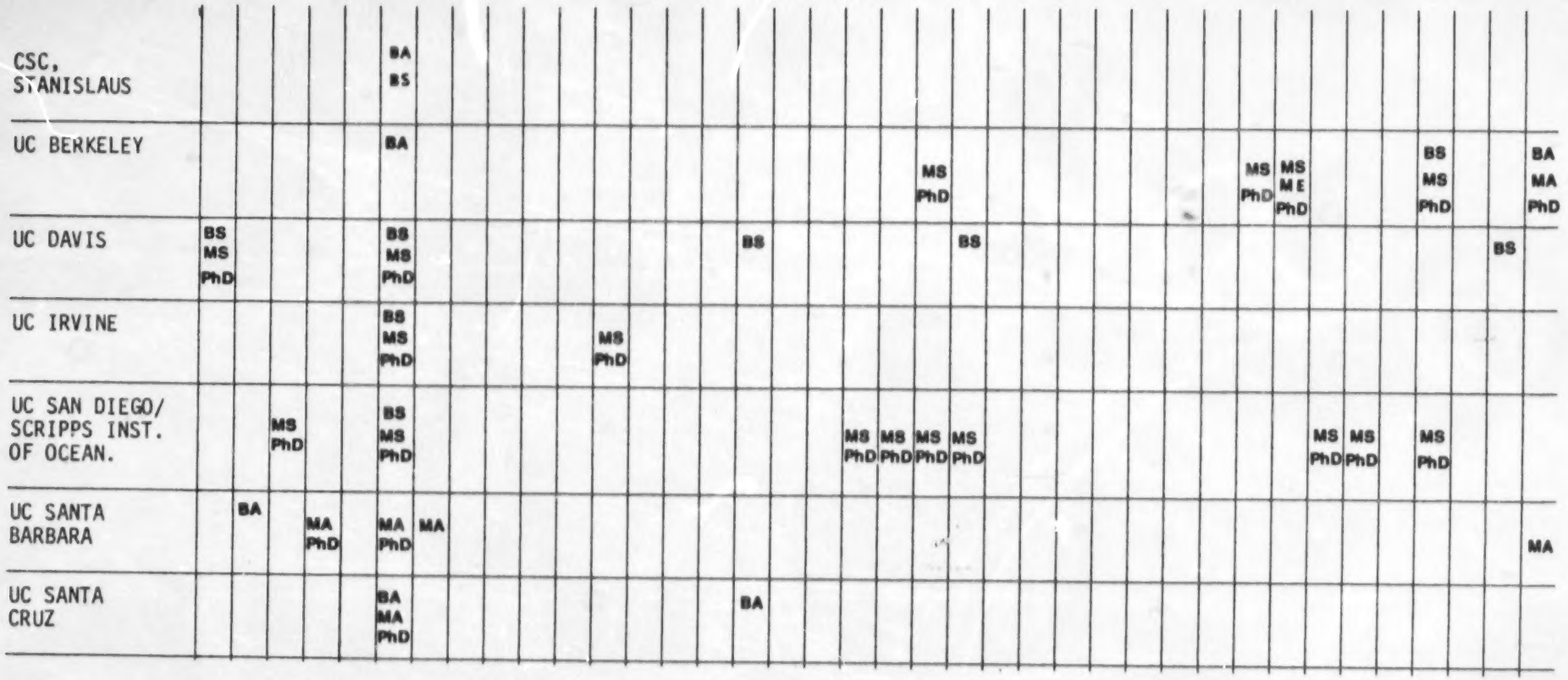

* Minor, emphasis or option